IRON AND STEEL ENGINEER

T. B. Little, Editor
John Kelly, Jr., Associate Editor
James D. Kelly, Advertising Mgr.

BOARD OF DIRECTORS
1935 • 1936

▲

PRESIDENT, G. R. CARROLL, *Electrical Superintendent, Jones & Laughlin Steel Corp., Aliquippa, Pa.*

1ST VICE PRESIDENT, F. W. CRAMER, *Superintendent, Elect. Const., Republic Steel Corp., Youngstown, Ohio.*

2ND VICE PRESIDENT, J. A. CLAUSS, *Chief Engineer, Great Lakes Steel Corp., Ecorse, Mich.*

DIRECTOR AT LARGE, C. A. KRAL, *Assistant General Manager, Wheeling Steel Corp., Steubenville, Ohio.*

HONORARY DIRECTOR, J. FARRINGTON, *Electrical Superintendent, Wheeling Steel Corp., Steubenville, Ohio.*

HONORARY DIRECTOR, E. FRIEDLANDER, *Pittsburgh, Pa.*

PAST PRESIDENT, W. H. BURR, *Electrical and Mechanical Superintendent, Lukens Steel Co., Coatesville, Pa.*

PAST PRESIDENT, W. E. MILLER, *Electrical and Mechanical Superintendent, Bethlehem Steel Co., Johnstown, Pa.*

TREASURER, C. H. HUNT, *Assistant to President, Weirton Steel Co., Weirton, W. Va.*

SECRETARY, J. L. MILLER, *Assistant Chief Engineer, Carnegie-Illinois Steel Co., Youngstown, Ohio.*

DIRECTOR, C. J. SMITH, *Superintendent of Auxiliary Departments, Carnegie-Illinois Steel Co., S. Chicago, Ill.*

DIRECTOR, H. G. R. BENNETT, *Assistant General Superintendent, Carnegie-Illinois Steel Co., Duquesne, Pa.*

DIRECTOR, STANLEY GRAND-GIRARD, *Mechanical and Electrical Superintendent, Sharon Steel Hoop Co., Sharon, Pa.*

DIRECTOR, C. R. TINSLEY, *Electrical and Mechanical Superintendent, United States Pipe & Foundry Co., Bessemer, Ala.*

DIRECTOR, M. J. CONWAY, *Fuel Engineer, Lukens Steel Co., Coatesville, Pa.*

DIRECTOR, C. C. PECU, *Lubrication Engineer, Bethlehem Steel Co., Lackawanna, N. Y.*

DIRECTOR, C. C. WALES, *Chief Engineer, Otis Steel Co., Cleveland, Ohio.*

DIRECTOR, L. F. COFFIN, *Superintendent Mechanical Department, Bethlehem Steel Co., Sparrows Point, Md.*

DIRECTOR, J. A. VOSS, *Manager, Industrial Relations, Republic Steel Corp., Youngstown, Ohio.*

▲

ACTING MANAGING DIRECTOR, T. B. LITTLE, *Empire Building, Pittsburgh, Pennsylvania*

VOL. XII OCTOBER • 1935 NO. X

Contents

31st Convention and Exposition 1

Tuesday, September 24th ..... 2 and 3

Wednesday, September 25th ..... 4 and 5

Iron and Steel Exposition ..... 6 and 7

Thursday, September 26th 8

Conventions News Items 9

32nd Convention and Iron and Steel Exposition 10

Industrial Relations—the Human Element in Industry—by Arthur H. Young, Vice President, United States Steel Corporation, New York, N. Y. 11

High Temperature Conveyors—A Novel Type for Heating Furnaces—by W. E. Blythe, District Manager, Driver-Harris Company, Detroit, Michigan 16

Roller Bearing Applications in Continuous Strip and Rod Mills—by S. M. Weckstein, Asst. Chief Engineer, Timken Roller Bearing Company, Canton, Ohio 23

Association Notes 30

Steel in Federal Projects—Billion Dollars for Steel and Allied Products—by E. H. Foley, Jr., Director of Legal Division, Public Works Administration, Washington, D. C. 31

Items of Interest 36

Index to Advertisers 11

Published Monthly by
ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS
Entered as second-class matter January 25th, 1924, at Pittsburgh, Pa., under the Act of March 3rd, 1879. Subscription Price $5.00 per Year. Single Copy $1.00

INDEX TO ADVERTISERS

A	The Alliance Machine Company	78
	Allis-Chalmers Manufacturing Company	66
	Aluminum Company of America	62
	Automatic Transportation Company	47
B	The Baker-Raulang Company	49
	The Bantam Ball Bearing Company	67
	The Bartlett Hayward Company	52
	Bussmann Manufacturing Company	38-39
C	The Cleveland Crane & Engineering Company	72
	Cutler-Hammer, Inc.	Cover 2
D	Driver-Harris Company	50
E	The Electric Controller & Mfg. Company	Cover 1-64-65
	The Electric Furnace Company	80
F	Farrel-Birmingham Company, Inc.	79
G	General Electric Company	Cover 4—58-59-75
H	The Hodson Corporation	45
	Hyatt Roller Bearing Company	61
I	Illinois Clay Products Company	44
	I-T-E Circuit Breaker Company	Cover 3
J	Jefferson Electric Company	63
L	Leeds & Northrup Company	48
	Lewis Foundry & Machine Company	71
	The Lincoln Electric Company	73
M	The Martindale Electric Company	76
	McGraw Electric Company	38-39
	Mesta Machine Company	46
	The Morgan Engineering Company	51
N	National Carbon Company, Inc.	77
	The New Departure Manufacturing Company	43
	New York & New Jersey Lubricant Company	79
	The Nichols Lintern Company	77
	Norma-Hoffmann Bearings Corporation	57
O	The Okonite Company	42
P	Pennsylvania Transformer Company	74
	Poole Foundry & Machine Company	70
R	Reliance Electric & Engineering Company	56
	Rockbestos Products Corporation	53
S	SKF Industries, Inc.	41
	B. F. Sturtevant Company	81
	Surface Combustion Corporation	54-55
T	The Thompson Electric Company	76
	The Timken Roller Bearing Company	82
	Tool Steel Gear & Pinion Company	68
U	Union Carbide and Carbon Corporation	77
	R. E. Uptegraff Mfg. Company	78
W	The Wellman Engineering Company	60
	Westinghouse Electric & Manufacturing Company	69

Board of Directors of A. I. & S. E. E. convening in session before opening of 31st Convention.

31st Convention and Exposition

SETS NEW RECORDS IN INTEREST AND ATTENDANCE

▲ FROM FOREIGN COUNTRIES including England, Canada, Cuba, France, Australia, Czecho-Slovakia, Japan, Germany, Scotland, India, Russia and twenty-one states of the United States came 15,000 steel mill engineers and executives representing 350 steel and allied companies to the 31st Convention and Iron and Steel Exposition of the A.I. & S.E.E. held in Pittsburgh, Pa., September 24, 25 and 26.

Beginning with the Board of Directors meeting on Monday evening, preceding the opening of the conference and following through until the last technical session was concluded on Thursday afternoon, there has never been equaled in the history of the society the intense interest displayed in the various affairs of the three-day gathering.

Conscious of the rapid recovery being made in the steel industry every operator and executive left nothing undone to insure himself of obtaining the most out of a technical program which included papers and discussions on every phase of steel mill operations. To fully round out the program and in keeping with what is occupying a considerable portion of the management's time, excellent papers were presented, and which may be found in other sections of this issue, on industrial relations in the steel plant and the distribution of steel in Federal projects. Outstanding in interest during the convention was the Iron and Steel Exposition. A total of 106 manufacturers of steel mill equipment put on for exhibition and display every conceivable type of device and machine necessary for the operation of a steel plant. Recognizing the high competitive factor in getting the attention of the executives and operators it seemed as if each exhibitor outdid the next one in setting up their material in an instructive and decorative manner.

To fully report the past Convention and Exposition would take a book. Therefore in this and following pages we are going to tell pictorially the story of a conference which is just the beginning of a new era for our Association —an era which will see the scope of the society being continually expanded to render the steel industry a greater service.

Beginning early Tuesday morning and continuing through the duration of the Conference a steady stream of steel mill executives and engineers registered for the Convention.

W. H. Burr, Chairman of the Development Committee, opening the meeting with a comprehensive report of happenings in the steel industry during the past year.

Continuing his many wonderful contributions to the Society, Stephen Badlam points out the progress in the sheet and strip mill phase of the industry.

Industrial Relations Receives Much Attention

▲

Company Unions Defended

Before an estimated audience of over one thousand interested listeners, Arthur H. Young, Vice President, United States Steel Corporation, defended the company union plan as practiced by the steel industry. As may be found in another section of this number, Mr. Young showed that men and management, convinced of their mutuality of interest, maintaining a reciprocated respect for each other, determine by their everyday contact the wholesomeness of the union.

In the upper right picture Mr. Young and Mr. B. F. Fairless, newly elected chief executive of the Carnegie-Illinois Company met before the opening of the meeting. Presiding as chairman of the session and shown with Mr. Young in the lower illustration, Charles R. Hook, President of the American Rolling Mill Company took an active interest in the various affairs of the convention.

Discussions on Strip Mills and Trip to Weirton Steel Co. hold sway on Wednesday

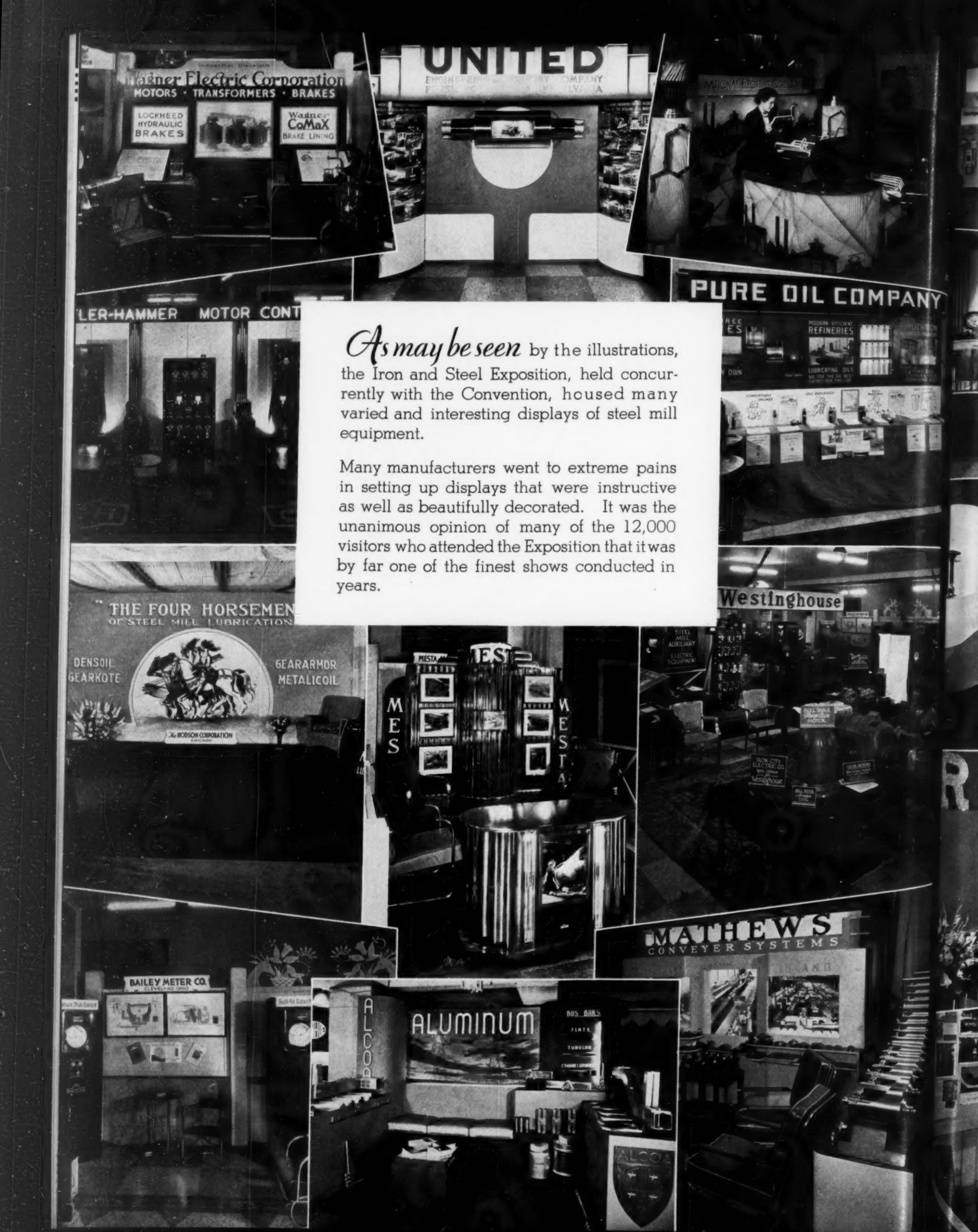
One whole day, Wednesday, was utilized to discussing the flat rolling of steel, the predominant theme of discussion among steel men of today due to the huge construction program being carried on at the present time. From every steel center in this and foreign countries came executives and engineers interested in this particular subject to hear the many excellent papers and discussions. The top picture shows F. E. Flynn, newly appointed General Manager of the Warren District, Republic Steel Corporation, who presided as chairman of the morning session, greeting F. D. Egan, Electrical Superintendent, Bethlehem Steel Company, Lackawanna, whose Company is in the process of building a new $20,000,000 strip mill. In the center may be seen R. J. Wean, President, Wean Engineering Company, Inc., pointing out the necessity of producing large sheets without strain or surface blemishes.

Unanimously acclaimed by the audience as having delivered one of the finest manuscripts on the flat rolling of steel ever compiled, C. L. McGranahan, lower left illustration, Superintendent 76″Mill, Inland Steel Company, well deserves many congratulations on the painstaking efforts he took in assembling his paper.

All of the papers presented at this particular meeting will be published in the December issue of the Iron and Steel Engineer.

Supplementing the technical discussions of the morning was an inspection trip to the Weirton Steel Company, Weirton, W. Va. At the invitation of J. C. Williams, President of the Weirton Company, a special train carried 800 members and guests down to the plant. Among the many interested steel mill executives who made the journey, upper right, were H. G. Gibson, Chief Engineer, McKeesport Tin Plate Company, R. Bell, Asst. General Superintendent, McKeesport Tin Plate Company and C. L. McGranahan, Inland Steel Company. Under the direction of C. H. Hunt, Chairman of the Inspection and Asst. to President, Weirton Steel, the members and guests were accorded a very hospitable welcome and interesting afternoon which can be evidenced by the cordial handshake between G. R. Carroll, President of the Association and C. H. Hunt, at the time of the departure of the train from Weirton.

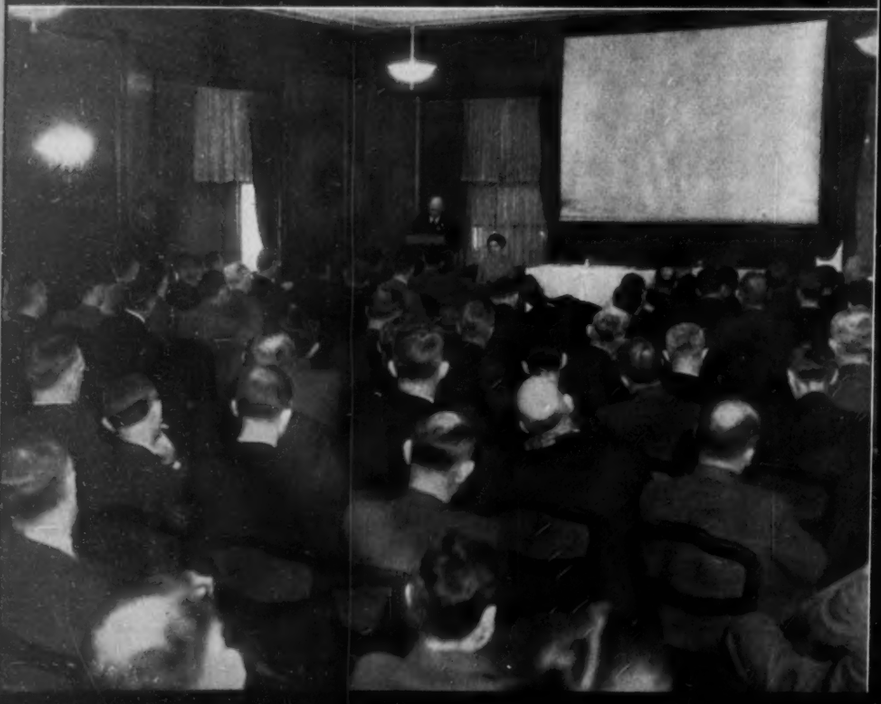
Bottom photograph illustrates interested guests inspecting equipment of the Weirton Company.



As may be seen by the illustrations, the Iron and Steel Exposition, held concurrently with the Convention, housed many varied and interesting displays of steel mill equipment.

Many manufacturers went to extreme pains in setting up displays that were instructive as well as beautifully decorated. It was the unanimous opinion of many of the 12,000 visitors who attended the Exposition that it was by far one of the finest shows conducted in years.

FARVAL
WESTON
GENERAL ELECTRIC
HOT & COLD ROLLED
YOUNGSTOWN
HYATT ROLLER BEARING CO.
HYATT
BRISTOL'S
RELIANCE
NATIONAL CARBON CO.
CARBON SALES DIV
NATIONAL CARBON CO. INC.
SA
GATKE CORPORATION
RYERTEX BEARINGS
NORMA HOFFMANN BEARINGS



Many Varied and Interesting Papers Presented on Last Day of Conference

Thursday, the concluding day of the convention, saw three sections, Welding, Combustion and Lubrication conducting meetings. In the top photograph is shown the Open Hearth meeting with J. A. Carter, Open Hearth Superintendent, Sharon Steel Hoop Company, Lowellville, Ohio, presiding.

In keeping with the broad aspects of the program, E. H. Foley, Jr., Director of Legal Division, Public Works Administration, showed the many projects of the agency which are absorbing large quantities of steel. In the center illustration reading from left to right, may be seen—Myron S. Curtis, Sales Promotion Manager, Youngstown Sheet and Tube Company, who acted as vice-chairman of the meeting, E. H. Foley, Jr. and Norbert J. Clarke, Vice President, Republic Steel Corporation, who presided as chairman.

The Mechanical and Lubrication Divisions held meetings which were attended by capacity audiences. In the lower left O. L. Maag, Lubrication Engineer, Timken Roller Bearing Company, is shown presenting an article on the subject of specifications for lubricants. Lower right photograph shows Gordon Fox, Vice President, Freyn Engineering Company and H. D. Esterly, Electrical and Mechanical Superintendent, Allan Wood Steel Company, discussing the interesting phases of the meeting.

Newspapers of the country, well aware of the importance of the conference, as shown on the opposite page, utilized thousands of lines telling the story of the convention.

...AST MARKETS FOR STEEL FORECAST

Air Conditioning, Housing Called New Fields

By GEORGE SNYDER
Business Editor

Two vital developments were seen in the steel industry as the ...of Iron and Steel ...today for ...

STEEL CHIEF HITS 'ALIENS' IN UNIONS

Convention Hears Federal 'Dictation' Attacked

Striking at "bureautratic dic... tion," and outside unions, Ar... H. Young, vice president of ... States Steel Corpora... defense of the com... steel industry ...

Today's Business

◆ ◆ ◆

It Was Really Hoop Skirts And Corsets That Started Strip Steel Business

By J. FRANK BEAMAN
Press Financial Editor

STRIP steel is as old as women's corsets and hoop skirts, instead of being a purely depression development and Pittsburgh is really the home of this particular branch of the industry, according to Frank Flynn, newly appointed general superintendent of the Republic Steel Co., of the Warren District.

Mr. Flynn took issue yesterday with those attending the convention of the Association of Iron & Steel Electrical Engineers ... William Penn Hotel who ... strip mill, to ... geem-

...negie and was honored by having a street named after him.

Finally he went to the Weirton Steel Co., where he rose to a superintendent and from there went with Republic which ha... the strip mill ex... profited through ... to busine...

STEEL EXPERTS ARRIVE IN CITY FOR CONVENTION

3500 Expected for Engineers' 3-Day Meeting In William Penn

Leaders of the steel industry gathered here today for the opening session of the thirty-first convention of the Association of Iron and Steel Electrical Engineers at the William Penn Hotel.

Approximately 3500 members of the Association are expected at the three-day convention.

W. H. Burr, electrical and mechanical superintendent of the Lukens Steel Co., Coatsville, Pa., opened the morning meeting with a discussion, "Developments in the Iron and Steel Industry, 1934-1935." ...to improved conditions in ... cited in-

TUESDAY, SEPTEMBER 24, 1935

LABOR BOARD'S 'FUTILITY' TOLD STEEL LEADERS

...ecurity Program ...ved by ...

Steel Convention Delegates Study Modern Methods Of Production; Trip to District Mills on Schedule

Technical Problems, New Uses Included on Program of Sessions

Technical sub...

...ests. ...he first strip ...at 42 years ago," acco... Flynn who ought to kno... cause he was one of those who ...ped turn it out.

"You remember the steel stays ...the corsets of women about 40 ...ears ago?" he asked answering ...ith "Well that was strip steel. ...nd hoop skirts had strip steel in ...hem.

Deposit Insuran... one way of showing the... that has taken place in ... country in two years, beca... these 34 and the ones who ...viously took the step obvio... for one reason or another, ...sider that public confidence ...banking structure has ...ted to the point ... insurance is ...ment.

...the 34 taking the... was the Union S... Pittsburgh, one ... group. Another w... ...d-Connecticut Tru... ...ually strong and im... ...ation.

...the case of the ...ings, which has dep... ...ut $20,000,000 the cos... ...deral insurance has be... ...5,000 a year, accordin... ...icials.

* * *

Union Trust Backi...

THIS bank is owned ... the Union Trust Co. ... the tradition of th... banking group would p... own resources behind ... Savings if any emerge... ...lop in the future. ... just didn't ... ...e fact the ... ...the Uni... were ...

...but be impr... that industry has carried... velopment work as never before," ... said. "As a ... comforts, ... proved proc... has enjoyed ... not have bee... other way."

Other spea... session were ... Badlam, Pitts... neer; S. F. ... Caldwell, of th... tric and Mani... Hildebrand ar... the General El... Arthur H. Y... of the United ... was to head sp... noon meeting. ... "Industrial Rela... G. N. Harmon ... tendent of the R... Warren District ... "Material Handli... Steel Industry, at ...

Equipmen...

In conjunction ... tion, an iron an... is being held in t... Chairmen at tod... clude: C. A. Tin... Republic Steel ... Grand-Girard, m... trical superintend... Hoop Co.; G. R. ... superintendent, J... Steel Co.; J. L. ... of engineer, Ca... town; Cha... America...

STEEL TO TAKE CARE OF OWN, EXPERT AVERS

Says Workers Need Not Fear Being Made Jobless.

NEW JOBS IN VIEW

INVENTOR GAV... AUTO NEW MATERIAL

Pioneer of Proce... Here to Attend Convention

By GEORGE H. SNYDER
Business Editor

The man who founded a hundred million dollar branch ... the steel industry told his s... today.

F. E. Flynn ...

CONVENTION EXPERTS HAIL DAWN OF NEW STEEL AG...

STEEL OFF... STRIKES BL... AT "MEDDLERS"

Company Union Plan In Labor Relations Defended.

A. H. YOUNG SPEAKS

Engineers Select Detroit For Convention to Be Held in 1936.

...growing mechanic... ...continuous wide strip mill, accord... ...ing to C. L. McGranahan, superin... ...tendent of the Inland Steel Com... ...pany's big mill at Indiana Harbor the strip ...

...dollar estimate ...bley, is based ...de by the ... Forty ... ...ld go ... Ind.

...but when ...ess he ...

...declared. ...ey came to ... Association ...trical Engineers ...onel H. B. Hackett, ...n for conferences ...sevelt on late p...

Urging "meddlers" to remember ...project ...rials, ...e ... ...that the human element "is the ... ...of greatest importance," ... ...ung, vice president of ... States Steel Corpora... ...day defended the em... ...esentation or so-call... ...union" plan of labor and better steel ...

...spoke before the ... Steel ... Iron ... ...rs, ...Hot... ...sea... ...tre... ...ch...

"The outlook, so far as labo... ...concerned, is not so pessimistic ... ...it seems," McGranahan told a gr... ...of technical and research men ... ...terday at the ... convention of the thirty-first an... Iron and Steel Electrical Engine... in the William Penn Hotel. ... ...modern method ... of making ... ...is a necessary forward step ... ...cannot be retarded, McGrana... declared. ... The "buyer's market" ... ...prevailed for a... ...been ...

Steel Engineers at Convention Set to Inspect Weirton Plants

Discussion of new processes in the production of steel ... and an inspection trip to the Weirton Steel Co... several thousand steel men busy at tod... that Association of Iron and Steel Electr... ...ears tion here. ...em More than 700 steel engineer... ...at I and executives were schedule... ...bu make the Weirton trip b... ...ti train this afternoon.

Speakers at this me... technical meetings included ... Wean, president of the Wean ...gineering Company, Inc., Warr... ...D.; C. L. McGranahan, superin... ...ndent of hot mills, Inland Steel ...mpany; S. H. Griffiths and J. ... Campbell, of the Ohio Steel ...ndry Company, and Dr. R. W. ...re and E. S. Reynolds, of So... Vacuum Oil Company. ...nificance of steel i... ...orks Admini... ...e emp...

AUTO INDUSTRY USING NEW STEELS

Technical Advances Set Swift Pace in Modernizing

By GEORGE H. SNYDER
Business Editor.

New kinds of steel, new ways of ... making steel, new uses f... are developing so ... industry ... ng up ...

This is ... sion gaine... of engineer... tend the co... ...ation of Iro... Engineers. ... The chance ...

ENGINEERS SET STEEL PACE

(Continued from Page Twenty-one.)

...turned out in great quantities and ... each user took about the same ... kind ... material.

...day the industry is get... a period of specializa... engineers point out. ...s are becoming more ... alloys are being de... ...tically every address ... ...y private discussion... ...nces to the prob... new specialized ...

...UTOS ...s the addres...

NEW YORK AMERICAN DEFENDS STEEL Company Union LABOR PLAN

PITTSBURGH, Sept. 24 (AP)—... Arthur H. Young, vice-president of ... States Steel Corp., made a ... the so-called "company ... relations to-

STEEL LEADERS TO GATHER HERE

Engineers, Executives To Meet Tomorrow in 31st Convention.

Pittsburgh will be in the spot... world again this ...

STEEL M... TO WE...

Discussion of ...

Mr. Carroll ... Sessio... three-day meeting will o... day in the William Penn ... The men responsible ... ing out the nation's stee... previe...

DETROIT

Selected for 1936 Convention and Exposition

At a board of directors meeting during the convention it was decided to hold next years convention in the city of Detroit. This decision was based on the fact that it was thought that the time had arrived for the men who make the steel to convene in the city which is the largest consumer of steel today. The dates for the annual conference will be September 22, 23, 24 and 25.

(Left)—View of Detroit showing the Hotel Statler which will be the Convention Headquarters.

(Right)—The Convention Hall where the Iron and Steel Exposition will be held.

(Lower left)—River Rouge plant of the Ford Motor Company showing an ore carrier unloading her cargo.

(Lower right)—View of the plant of the Great Lakes Steel Corporation at Ecorse, Michigan.

INDUSTRIAL RELATIONS

THE HUMAN ELEMENT IN INDUSTRY

By ARTHUR H. YOUNG, Vice-President
United States Steel Corporation
NEW YORK, N. Y.

Paper presented before the A. I. & S. E. E. Convention, Pittsburgh, Pa., September 24, 25, 26, 1935.

▲ MEMBERS AND GUESTS of the Association of Iron and Steel Electrical Engineers—I confess to a peculiar feeling of satisfaction in participating as a guest for the second time in the program of your Association. But few of you who are here present will recall the first occasion on which I was honored by having this Association as my host. That was at the 1912 Convention, in Milwaukee, to which your Association had invited safety inspectors from the manufacturing, transportation and mining industries, and the state and federal officers interested in accident prevention work, and it was my honor to have been among that group, because of my position as safety inspector of the South Works of the Illinois Steel Company.

The explanation for, and the outcome of the participation of the safety men in your program is set forth in Resolutions of your Association, adopted in 1912, as follows:

> WHEREAS, The Association of Iron and Steel Electrical Engineers regarding as worthy of particular attention the hazards to life involved in electrical operations in steel mills, and appreciating the importance of the General Safety Movement not only in electrical engineering, but also in the steel industry as a whole, and in all the other varied and important industries of our country, and having met with such prompt cooperation in their proposals to establish a National Organization devoted to securing increased safety to human life, have reached the conclusion that such an organization can best be brought about by action of this joint meeting of the Association of Iron and Steel Electrical Engineers and the Co-operative Safety Congress, and it is, therefore, hereby
>
> RESOLVED, That the President of the Association of Iron and Steel Electrical Engineers be requested to take the first steps towards the formation of a National Organization for the promotion of safety to human life by appointing a Committee on Permanent Organization, which shall contain representatives of the Federal and State Agencies already established to supervise conditions of safety in our industries, and shall also contain representatives from the Mining, Transportation and Manufacturing Industries of the United States, and be it further
>
> RESOLVED, That the Committee so appointed shall be and hereby is authorized by this Congress to organize and to create a permanent body devoted to the promotion of safety to human life in the industries of the United States; this Committee to have authority to call future Congresses of safety, increase its membership if it so desires, and to do such other acts as will promote the object for which it is established.

ARTHUR H. YOUNG presenting paper at Convention on September 24, 1935.

As a past president of the National Safety Council, I desire to pay public tribute and to express, on behalf of the thousands of safety men who are now members of the National Safety Council, our appreciation of the far-seeing vision and the energy of your illustrious

past president, Lewis R. Palmer, who was so largely instrumental in bringing about the formation of the National Safety Council.

If this act of mid-wifery on the part of your Association were its only accomplishment, instead of being but one of many significant contributions to the progress of our industry and our nation, certainly, it alone would justify your efforts, for this act alone has meant, and will continue to mean that many, many people in all walks of life have risen and will continue to rise and call you blessed.

When I received your invitation to participate in this program, these early recollections of the Association flashed through my mind, and, with them, a realization of the profound change in the character of the program of a safety convention of those days as contrasted with the program of the Twenty-Fourth Safety Congress, to be held in Louisville, next month. Whereas, in those early days, we safety men were mostly concerned with mechanical guarding as a means of preventing accidents to men at work, the ensuing years have witnessed the expansion of the safety man's technique from that of an art to what is practically a science and, instead of the employment of mere mechanical contrivances in the mills and mines, it now calls upon the research and best administrative efforts of the leaders in nearly every walk of life. Today, the head of every industrial establishment or educational institution or traffic control department, the leaders in our churches and the heads of municipal, state and federal departments are as much concerned with the problem of accident prevention as was the lowly safety inspector working almost exclusively in that field less than three decades ago.

And I am no less impressed with the spread in importance of the work of your own Association, as is indicated in contrasting the program of this session with that which I attended in 1912. Today, the electrical engineer in the iron and steel industry is not so much concerned with the adaptation of electricity as a prime mover as he is in its application in the finer and more involved problems of controlling the chemical and physical properties of steels, their fabrication, heat conservation, and infallible automatic control devices as a supplement or alternative to manual effort. Your research program holds promise of even more revolutionary changes in the technique of steel making.

In view of the tremendous part played by the electrical engineer in our industry today, it is not trite to state that perhaps the major part of our continuing and future success lies in the vision, the ability and the consecration to effort of the electrical engineers. I hope the sincerity of my attempt to thus pay tribute where tribute is due may pardon this lengthy digression from my subject.

Industrial Relations—Well, certainly that is a broad topic, especially as it relates to its present status. Broadly defined, it has to do with every phase of employer-employee relationships. Through the recent introduction of new agencies and the over-accentuation of others, the administrative machinery of an industrial relations program has become so clogged with gadgets, and "isms" and "ologies" as to warn us that, only through steadfastly clinging to fundamental principles of proven value will the machine be able to utilize its energy in bringing forth a fair product, rather than expending it all in useless friction.

More than fifteen years ago, a group of industrial relations executives, who were representatives of the great body of employing power and employee sentiment in America, wrote and published a document from which I extract the following paragraph:

> "The human element in industry is the factor of greatest importance. Capital cannot exist without labor and labor without capital is helpless. The development of each is dependent upon the cooperation of the other. Confidence and good will are the foundation of every successful enterprise, and these can be created only by securing a point of contact between employer and employee. They must seek to understand each other's problems, respect each other's opinions, and maintain that unity of purpose and effort upon which the very existence of the community which they constitute and the whole future of democratic civilization depend."

Even to the conservative mind, that paragraph is nothing more than a clear and concise statement of a vital truth, a fundamental, economic fact.

There is one sentence which I would pick out of this declaration, which is my text today, and drive deep into the consciousness of every man engaged in industry, whether he be employer or employee and, likewise, would I drive it deep into the consciousness of every "kibitzer," who, behind the mask of assumedly necessary social reconstruction of our national life would, without invitation from the players, change the rules of an ancient and honorable game, even though they themselves be not the players of the hand. That sentence is: "*The human element in industry is the factor of greatest importance.*" On these eleven words hang "all the law and the prophets" of the American industrial gospel. They point and illumine the pathway toward, if not all the way to, an industrial relation which shall produce a more durable peace, a sounder progress and a truer prosperity than our peaceful, progressive, prosperous industrial America has yet enjoyed.

It will require no argument and few words to hook up my text and the assigned subject of this talk. They couple automatically. Successful production, the existence of the community, the future of our civilization demand a point of contact between employer and employee, from which shall come mutual understanding, mutual respect and mutual purpose and effort.

And where is the point of contact today under any workable system, expressing the modern theory of industrial relations? It is still, as in the past, in part in the foreman but in a foreman who could not play the tyrant with even one man under him, for one minute, and would not if he could; and it is in larger, higher part in the idea and the mechanism of some kind of employee representation. In a word then, the phrase of our text, "A point of contact between employer and employee" is practically synonymous with employee representation. We get from employee representation a living, humanized, vitalized and continuous contact. We get an understanding of the condi-

tions we must meet, and the problems we must solve that is entirely mutual. We get far better understanding by each side of what is on the other side's mind. Out of the new point of contact we get a unity of purpose, unity of effort that comes from mutual understanding, respect and confidence.

Just as the function and the technique of the safety engineer and the electrical engineer have changed mightily in a short span of time so, too, has and will continue to change the function and the program of our industrial relations activities, and I make bold the statement that the pendulum of change will swing over a far wider arc in the sphere of industrial relations than it will in any other line of endeavor. Industrial relations are *human* relations. For every employee and for every employer in the industry it has to do with the nature of each and every job, the manner of doing that job, its monetary compensations, the security of the man on the job, the influence which factors outside of the job exert upon the job and the man. It has, in short, to do with the physical, mental and social well-being of every employee and, recently, some would have us believe it to be related likewise with his political well-being.

These problems are not primarily mass problems as to either their psychological or physiological, their social or their economic factors. They are mass problems only as the sum of the individual problem of every employee and every supervisor and every executive become mass problems. But their very essence, the very root of them lies in the individual attitude, the individual fitness for his job and satisfaction in his association therewith of each particular employee and his boss.

We hear much discussion, these days, about "the labor problem," and many "solutions of the labor problem" are offered from sources sometimes near to, but more often actually remote from the point of real concern, namely, the man on the job and the management of the company for which he works. We are told that the day of rugged individualism has passed, and in its place has come some sort of collectivism which usually, in its description, approaches the form of state socialism. We are told that the workers' principal concern today is security—security of life, security of livelihood, security for his children, and assurance of his and their abundant life—and that he must needs look for these benefits to guarantees furnished by our political government.

And we are told of this as a "discovery"—that it is something new, emerged out of a recent cataclysm. You men know, better than any other group, the fallacy that security of life is a newly discovered wish on the part of the man on the job or his employer. It was this very group which, recognizing the spread of the general safety movement more than twenty years ago, precipitated the formation of the National Safety Council and, through that organization, crystallized the joint and united efforts of employees and employers to accomplish security of life and of limb. To an amazing extent that security has already been accomplished, and the efforts to further extend that security have not been and never shall be lessened as the joint and the immediate concern of men and management. It was by the deliberate planning, and the patient effort of industrial safety men that concern for the conservation of life and limb of school children, people in their homes, persons on the highways and on the seas has been awakened and followed by organized effort and appropriate channels in all those fields.

Security on the job—Is that a new thought in the mind of the worker? Is that a new responsibility on the part of management? Certainly not. Long before the birth of the safety movement, it was alike the concern and the objective of industry generally. For the employee there was not only the hope but the assurance that his security on the job would be assured to the greatest possible extent by his employer were he to devote himself zealously to their mutual best interests—the success of the business. In the minds of most of the employers there was more than the conviction, there was the knowledge that the experienced man on the job had a value not only because of his better productive effort, but because of his very attitude toward that job that far transcended what value could be assigned to those factors on the part of the transient or newly-hired employee. The cost and disadvantages of labor turnover were a topic of discussion and a challenge to industrial management many, many years ago. My own personal experience and participation in these efforts began nearly thirty years ago and I, like you, can testify to the startling and amazing success which has attended the efforts of men and management in this respect.

Security in the worker's old age—some would have us believe that that too, is a newly-recognized concern in this nation. For nearly twenty-five years the United States Steel Corporation has had in effect an entirely voluntary, noncontributory pension plan, benefitting those of its employees who, having served faithfully on their jobs, can look for support after their retirement not only to the pension plan itself, but to the accumulated and invested savings, the homes they have been aided in purchasing, and the group life insurance to which they have subscribed at exceedingly low cost.

The United States Steel Corporation has expended more than sixty millions of dollars in direct pension payments to its retired employees. Thousands of its employees are today the owners of homes bought under its generous home ownership plan. And its employees are carrying more than 300 million dollars of life insurance, at a cost to them of $9.00 per year per thousand dollars.

Does this indicate that concern for security on the job, or when adversity overtakes an employee while on the job, or when the job is finished are new and startling subjects? Rather, does it indicate that the American workman and the man or the management for whom he worked (the personnel of which, in this country, to a greater extent than anywhere else, is made up of men who have themselves risen from ordinary employment to these ranks) have always had a realization of each other's problems, and a knowledge that their solution lay in mutual endeavor. And, furthermore, that they have, themselves, worked out

the answer to the problem in a manner which has made our industrial prestige, the standard of living of our employees, and the worth-whileness of American citizenship the marvel and the envy of the whole world.

True it is that, in the earlier days, contact between men and their employers was more direct. And true it is that with the evolution of industry so largely into units of tremendous size, and high mechanization, the difficulties of maintaining close and effective contact between men and management have increased, and formal organizational efforts to this end have been required. But the success of the changed technique is even greater than that accomplished under the old.

Today, the man in the street hears, perhaps for the first time, but certainly with new emphasis of, "company unions," or, more often "company dominated unions." Mostly, the tellers of these tales to the man on the street or the public at large, would have it believed that these are devices whereby the relationships of the contact-medium between the man on the job and his employer are cunningly and devilishly designed to place the employee wholly at the mercy of his ogreish, despotic boss. Based on this false and scheming picture is raised the implication that his only means of salvation, his only means of fair contact with his boss is through some form of outside organization, with the method of contact and the accomplishment of collective bargaining, made, altered and dictated by a political bureau.

Let us examine the structure of one of these devilishly concocted "company unions." I have here the plan of Employee Representation at the Gary Works of the Illinois Steel Company, a subsidiary of the United States Steel Corporation. It is similar to the plans in effect at more than one hundred plants of the Steel Corporation, and many, many hundreds of plants in other companies in the iron and steel industry, and in all manufacturing and producing industries. The plan was worked out jointly in conferences between representatives of the management and duly and freely chosen representatives of the employees.

It provides, first of all, that the plan so developed can only be effective when accepted formally by the management, and ratified by a majority vote of the employees in a secret ballot, conducted exclusively by the employees themselves, and that the plan so adopted shall be in force only so long as the employees themselves desire. They alone, by referendum ballot, have the right to abrogate the agreement. The heart and core of the plan is the provision for setting up a group of representatives, freely chosen by the employees, and a similar group of representatives of the management, designated by the company. These representatives hold office for one year. The annual elections of the employee representatives are conducted by secret ballot, from appropriate divisions of the plant, designated or subject to change by the employees themselves. The employees may elect as their representatives whomsoever they choose, save only that he may not be an official of the company, possessing the right of employment or discharge. The two groups, management representatives and employee representatives have equal voting power, irrespective of their numerical personnel. To this group can be referred for discussion and settlement any matter—wages, or hours, or working conditions, or anything that affects the mutual interests of men and management, provided that the matter is first taken up in the regular, every-day, common-sense method of referring it to the foreman or the official who would be concerned with it, as a matter of routine administration.

The employee representatives are guaranteed an entire independence of action, and are completely safeguarded against discrimination in their employment because of any of their acts as representatives. The employees are guaranteed against discrimination as to race, or creed, membership or nonmembership in any labor organization.

The plan is subject to amendment at any time insofar as it relates exclusively to matters of employee concern by the employee representatives themselves, and it can be amended, insofar as it relates to details of joint procedure by the joint action of the employee and the management representatives. It provides that any matter, having been referred to the foreman or appropriate official, and not settled to the satisfaction of the employees, can be referred for the joint consideration of the employee and management representatives, and their decision is reached upon a 50–50 participation, an absolute guarantee of equality of bargaining power. There is provision for arbitration of any matter which may not be susceptible of final conclusion in the joint meeting.

Copies of the plan are in possession of every employee and may be had on request by any person interested in its examination.

This is the challenge I offer with respect to the fairness of this plan and its complete acceptability to the men and the management—if any person or group can suggest an amendment to the plan, or the inclusion or deletion of matter which would make it more just and fair to the employees and management and the buyers of our product, who are the customers alike of the company and the men, such a suggestion of amendment or deletion or expansion will be formally offered for adoption by the company and the employees. The plan itself has been agreed upon by these interests only after the most careful study and the frankest of discussions with the controlling motive being to secure the most practical plan that, recognizing both the exclusive and the joint concern of either side, would present a practicable, just and expeditious manner of maintaining continuous contact between them. There is nowhere in the plan a suggestion of dominance by either the management or the employees, save only in those spheres where, by long-established custom, and mutual agreement, the individual rights or interests of the men or the management are supreme over their joint rights or interests.

This plan of employee representation is not dissimilar in important respects from other plans that have been in existence for more than fifteen years, and like those other plans, was introduced not so much for the purpose of collective bargaining of which we hear so much today, and in which the accent seems to be so

definitely on the "collect" part of the phrase, as they were introduced and developed to maintain that desirable and necessary contact between men and management upon which, as I have said in my earlier quotation "grows that confidence and good will which are the foundation of every successful enterprise and which can be created only by securing a point of contact between the employer and employee." What better device can be had whereby they can "understand each other's problems, respect each other's opinions, and maintain that unity of purpose and effort upon which the very existence of the community which they constitute and the whole future of democratic civilization depend."

Nevertheless, employee representation as I have thus described it is not accepted as a panacea for all labor matters by all labor groups, nor by all management groups. The poll conducted by the Automobile Labor Board throughout that industry showed conclusively that probably a majority of employees are not primarily interested in collective bargaining or in representation of any form. It would seem perfectly natural that here in America the typical workman would feel that his acceptance and continuance at work on a job, and all of the inter-play between himself and his boss, brought about thereby, would be settled directly by his own individual, personal contact with his own individual, personal boss. That prescription has met his needs successfully and, until he is dissatisfied with its result, he is not particularly keen to change.

It is extremely doubtful if this particular point will be resolved with any definiteness through the workings of the new National Labor Relations Act. The difficulties attendant upon the attempt to resolve questions of this kind through legislation are, perhaps, indicated in the fiasco of national prohibition. It is probable that the final answer as to what constitutes proper industrial relations machinery can be and will be given only by Mr. American Workman himself. If, in his opinion, he is assured of a square deal while on the job, and if he knows that his boss is on the square with him and will play ball with him on a 50–50 basis on any matter of mutual concern, then he will never permit the arrangements which have given him this assurance to be set aside at the dictation of an alien group and accept as a substitute therefor an arrangement which takes from him his rights as an individual employee, or as a member of a group, his privilege of selecting whomsoever he will as his spokesman, if, as and when he needs a spokesman.

It is a homely, but peculiarly applicable simile, to liken the development of sound and harmonious relationships between men and management to the working out of a sound and harmonious relationship in marriage between a man and his wife. Both depend upon a mutual conviction that their interests in life are largely in common, at least to the extent that they should form an alliance. Both require for fulfillment at least a mutual respect of the contracting parties for each other, and preferably real admiration. Both require that, out of this commonalty of interest and mutual respect, there shall develop a "give and take" attitude in their everyday association together, and both require that, out of the alliance, there shall develop for each party, an increasing enrichment of their lives, and social and economic security.

It is in the way that a man and a woman, by themselves, acquire these attributes that, in 99 out of 100 cases, a satisfactory and happy married life emerges. No impersonal third party can lay down arbitrary laws or rules that will govern the result—it is the way in which they live together, day by day, that determines. Occasionally a friend of one or both may offer helpful advice or admonition. Even under the flag of friendship, the overtures may be hazardous—inevitably it is so if the counselor be "suspect" by either party.

Just so it is in the case of industrial relations. Men and management, convinced of their mutuality of interest, maintaining a reciprocated respect for each other, determine by their everyday contact the wholesomeness of the union. Occasionally, a friend, known to them and accepted by them may offer suggestions or reproof to good advantage—but it is no more possible to set up a national board to lay down the law and the gospel to all employees and all managers in all industries in this far-flung land of ours than it is to set up a similar board to regulate the relation of all married couples.

The very nature of the problem of maintaining continuous contact between the men and management on all of their problems of mutual interest in itself precludes codification and regimentation and bureaucratic dictation.

Perhaps I am foolish not to take a page from the book of Huey Long and abstain from quoting the Bible to you, yet there is a quotation that has recurred to me frequently during the past two years as applicable to our present situation. You will remember that firey old prophet, Jeremiah, and the way in which he protested against the things that were happening in his time. His people had departed from the ways of their forefathers and no longer followed the teachings revealed to them by their God. In consequence, they were no longer a prosperous and peaceful people, and their progress was far different from that which had been their experience so long as they had remained true to the faith of their forefathers. The teachings of false prophets had brought with them corruption and vice and disaster. And all of this time, Jeremiah vainly attempted to call them back from these false gods, to deafen their ears to false prophets, and to return to the ways and teachings of their forefathers.

In this present milieu, amid the new propaganda and the "isms" and "ologies" that are being spread across our nation, I can almost hear his warning now, as he uttered it thousands of years ago, "The prophet that hath a dream, let him tell a dream; and he that hath my word, let him speak my word faithfully. What *is* the chaff to the wheat? saith the Lord," or, again, "Behold, I *am* against them that prophesy false dreams, saith the Lord, and do tell them, and cause my people to err by their lies, and by their lightness; yet I sent them not, nor commanded them: therefore they shall not profit this people at all, saith the Lord."

HIGH TEMPERATURE CONVEYORS

A NOVEL TYPE FOR HEATING FURNACES

By W. E. BLYTHE, District Manager
Driver-Harris Company
DETROIT, MICHIGAN

Paper presented before the A. I. & S. E. E. Convention, Pittsburgh, Pa., September, 24, 25, 26, 1935.

▲ THE TEMPERATURES attained in the various processes through which steel passes principally in the finishing stages have steadily increased during recent years and with these higher temperatures have come increasingly difficult problems for the designer of the conveying mechanism required to carry the steel through these processes. The processes mentioned would properly include anything coming within a temperature range of 1400 deg. F. to 2000 deg. F. and would embrace the heating of packs and pairs, open and blue annealing of sheet and strip, pipe annealing and finally at the highest part of this range, normalizing of full-finished sheets.

It is not such a far cry back to the days of the early Costello furnaces employing large revolving brick drums bound together with strap iron. And only about ten years have elapsed since consideration was first given to the matter of changing the water-cooled shafts employed in the early furnaces of the so-called "roller-bottom" type to alloy shafts that would not require this expensive protection. The Company with which the writer is associated was early interested in these problems and installed its first alloy non-cooled shaft with discs early in 1926.

Frankly, in those early days of the application of heat-resisting alloys to steel-mill requirements, (altho some ten years after the first heat resisting castings were made by our Company in 1915) practically nothing was known of the phenomenon that we now term "creep". The alloy then mostly used was "Nichrome" analyzing approximately 60% Nickel and 12% Chromium and we knew that at 1900 deg. F. the cast alloy would stand a quick-pull tensile stress of 10,000 pounds per square inch and designed up to about 25% of that figure. Our present knowledge of the performance of various nickel-chrome alloys at normalizing temperatures indicates, of course, that even 25% of that 25% is usually excessive. These early shaft conveyors ran at higher fiber stresses and were comparatively short lived if rotation was not interrupted.

The design trend, in the early days of alloy non-cooled shaft conveyors was, therefore, toward lower and lower fiber stresses which were attained by increasing center diameters and center wall thicknesses until the weight of alloy per square foot of hearth area became excessive. And the rapid introduction of the "walking-beam" type of furnace some seven or eight years ago was due in large measure to the saving in alloy cost per square foot of hearth area that this type of conveyor made possible.

It has always been our feeling that the old "roller-bottom" type of furnace had much to commend it to the steel industry and that an effort to improve it and make it commercially competitive with other types was well worth while. This type of furnace employs a pure rotary motion which, from a mechanical upkeep standpoint, is usually preferable to reciprocating motion, its various parts are simple and easy for a mill mechanic to understand and service, and, lastly, these parts stay in the furnace, operate at fairly constant temperatures, and are not removed from the furnace with consequently heavy heat losses as for instance the chains and chain-blades of the "chain-type" furnace. The cross section of a typical shaft, having usually an outside diameter large in comparison with its wall thickness, places the bulk of the alloy at a fairly great distance from the neutral axis thereby using most efficiently every pound of alloy put in the shafts as well as facilitating accurate calculation of the fiber stresses involved. Furthermore, ample combustion space is available beneath the conveying mechanism thus making possible a liberal degree of under-firing with all that that means for even heating of product and rapid production per square foot of hearth area.

The distance between outside bearings in the usual "roller-bottom" furnace is about four feet greater than the inside width of the furnace. Thus a furnace 7 ft. wide inside would require a shaft span of 11 ft. which at normalizing temperatures presents no mean problem to the alloy conveyor designer. Coupled with this is usually the requirement of close spacing of shafts which, if 16″ diameter discs are to be employed places a very definite physical limit on the outside diameter of the shaft. As an example, assuming the necessity of employing shafts in a furnace 7 ft. wide on 12″ centers, and the desirability of limiting the maximum fiber stress to 300 lbs. per square inch this would not be possible with outside bearing shafts, carrying 16″ diameter discs as a shaft with an outside diameter in the center of the span of 12″ would be necessary. With ½″ clearance between each shaft and the discs on the adjacent shafts, the largest shaft that could be installed would be 7″ outside diameter. There are many old-type "roller-bottom" furnaces now in service with this

physical limitation imposed on the shafts with the result that the shafts are stressed to values considerably higher than prudence in design would sanction. Such shafts must be kept rotating while hot, whether loaded or not, and many instances are known where, by reason of driving-power failure, such shafts have sagged of their own weight and caused expensive shutdowns as well as heavy repair losses.

It would therefore seem that any reasonable means that might be devised for lowering materially the fiber stresses at which these shafts must operate would make for more successful operation, and certain means might also result in lower first cost of alloy as well as lower alloy cost per ton of steel produced.

Some five years ago, we were convinced that the most effective means of accomplishing these results lay in giving the revolving shaft ample support within the furnace itself. We had already done an appreciable amount of work on the use of alloy bearings at temperatures up to 1700 deg. F. and the main problem lay in extending this experience up through the temperature range of 1900-2000 deg. F. Before proceeding further with a description of the earlier work along these lines let me point out the many advantages which internal supporting of these shafts at first seemed to us to have; and I might add that these advantages have been confirmed in five years of subsequent practice.

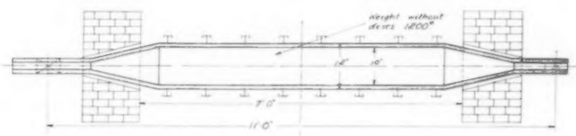


Fig. 1

Fig. 1 outlines as simply as possible the required dimensions of an outside bearing shaft in a furnace 7 ft. wide. The distance between bearings is 11 ft., diameter of discs 16″ and loading five pounds per square foot of hearth area. Such a shaft, to have a maximum fiber stress of 300 pounds per square inch would require a center outside diameter of 12″ and a center wall thickness of 1″. You will note that the weight of such a shaft (without discs) is approximately 1200 pounds.

You will also note that because of the diameter of this shaft closely approaching the diameter of the discs the latter are reduced to mere strips and it is practically impossible to effect any reasonable kind of interlocking between adjacent shafts. The tapered section on each end also has to extend far into the walls making it difficult to effect a tight seal at those points.

We now come to a shaft Fig. 2 that is supported by means of bearings mounted adjacent to the inside walls of the furnace. Our span here is only 6′ 8″ or but 60% of that required for the previous outside-bearing shaft and we find that with the same loading and spacing as before we can go down to a 6⅜″ outside diameter shaft with a ¾″ wall and still observe the same maximum fiber stress of 300 pounds per square inch. Such a shaft (without discs) would weigh only 350 pounds and the difference of 850 pounds between its weight and the weight of the outside bearing shaft could be entirely used up in the two inside bearings and still present some operating advantages. As a matter of fact, however, the necessary bearings would consume only some 200 pounds of this difference leaving us still 650 pounds of alloy per shaft to the good.

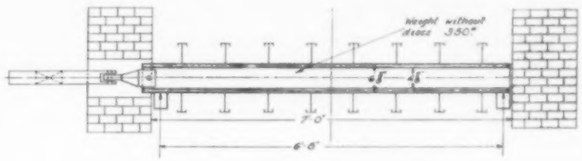


Fig. 2

Pursuing this same development further, let us now try placing the inside bearings on floor supports and between the discs, using a two disc overhang on each bearing Fig. 3. We now come down to but 3′ 4″ span between bearings which is less than one third of that required by the outside bearing shaft and we find that, with the same loading and spacings, the use of a shaft 3½″ outside diameter with a ⅜″wall will just bring us up to the specified maximum fiber stress of 300 pounds per square inch.

There is a little point in statics in this design that is apt to escape one at first sight but which deserves some consideration. The cantilever overhang on each side of these bearings has a very beneficial effect on bringing down the maximum bending stress entirely apart from the shortness of the center span. The bending moments caused by these overhanging ends and their loads act in the opposite direction to the bending moments caused by the center span and its load, so that the resultant bending moment in the middle of the center span is far less than it would be if that span preserved its same size and loadings and the overhangs did not exist. As a matter of fact, in the layout shown above, the bending moment in the middle of the center span is a reverse one, causing a fiber stress of only 46 pounds per square inch in the opposite direction to that in which we are accustomed to think. That is, the shaft here is in tension on the top and compression on the bottom. The maximum bending moment occurs at the edge of the bearing on the drive side and is limited to 300 pounds per square inch as previously determined.

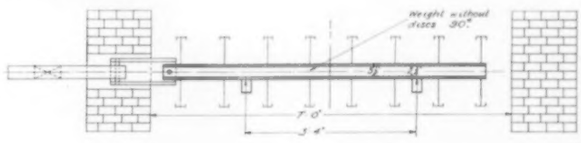


Fig. 3

I might say that in laying out these shafts we endeavor to equalize the three maximum fiber stresses, viz., those two at the outer edges of the bearings and the one in the middle of the center span and with shafts that employ no discs this can be done with accuracy. When discs are used, however, the bearings

cannot be moved over less than one disc spacing and inequalities cannot be avoided. The proper bearing spacing will vary with the disc spacing and load.

It will be noted here, that our shaft weighs only 90 pounds without discs or less than 8% of the weight of the outside bearing shaft. Allowing about 200 pounds for bearings, couplings, etc. there would seem to be here, therefore, a possibility of reducing the alloy weight per shaft by around two thirds and this is actually borne out by definite figures from the field of furnaces of the width outlined.

You will note that there are two other advantages which naturally accompany this design. In the first place, the wall of the furnace opposite the drive is completely closed thus giving a tighter furnace than

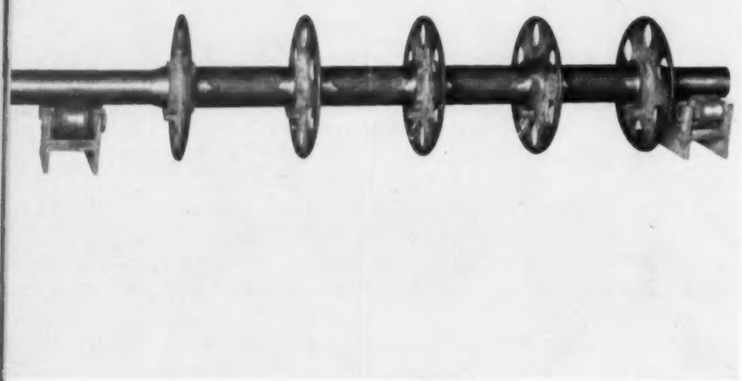


Fig. 4

usual as the number of outside openings are reduced by one half. In the second place, the decreased size and weight of the rotating shaft make possible the use of smaller wall openings to permit their installation and removal and facilitates greatly the effort required to lift them in and out. In a furnace of the 7 ft. width given we have replaced shafts within thirty minutes time without cooling the furnace down.

Having seen such interesting possibilities on paper, we next installed the shaft shown on Fig. 4 in a sheet mill in the Pittsburgh district in 1931. We gave this a very gruelling run in our own plant at 2000 deg. F. and on oil fuel for six months before shipping it and it ran about an equal period of time in this Plant on natural gas fuel at 1600-1800 deg. F. before the furnace was shutdown indefinitely and the shaft returned to us for inspection. It showed very little signs of wear and the small rollers on which the shaft turned had practically no reduction below their original machined dimensions.

Accordingly in March, 1933 we started up our first large installation in the plant of the Inland Steel Company at Indiana Harbor, Indiana. Fig. 5 shows

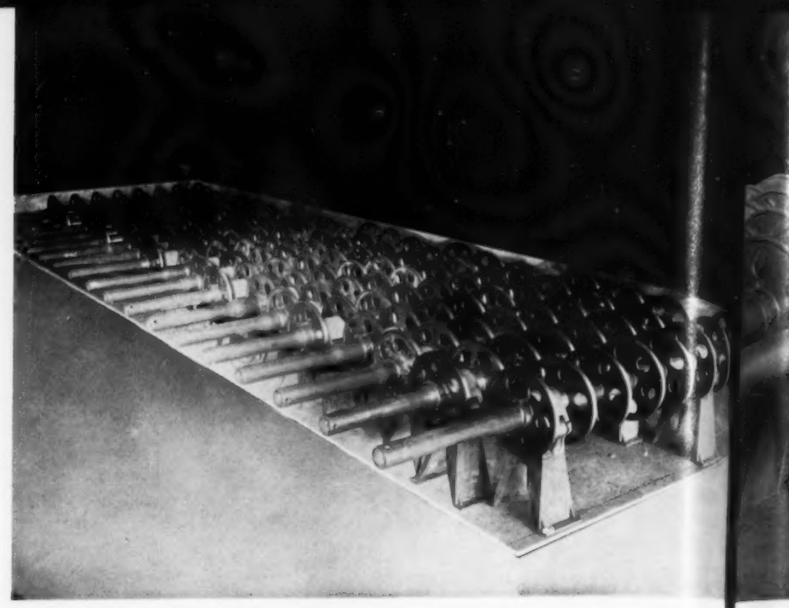


Fig. 5

half of the thirty eight shafts in the fifty foot heating zone of this furnace. The shafts are spaced on 18″ centers at the charge end of the furnace and on 15″ centers further in. There are eight 16″ outside diameter discs per shaft and the shafts are $4\frac{7}{8}$″ outside diameter in the middle with a $\frac{5}{8}$″ wall. The bearings are $46\frac{13}{32}$″ apart in the main body of the furnace and $55\frac{11}{16}$″ apart in the charge end. The weight of an entire shaft assembly with discs and both bearings is less than 600 pounds. The furnace is fired with 7.8°B oil which is gasified in special chambers shown on later illustrations and is used about half the time for normalizing at temperatures up to 1940 deg. F. and half for blue annealing at temperatures up to 1600 deg. F. For quick cooling, provision is made for stopping the heating-zone shafts and speeding up the cooling-zone shafts to a discharge speed of 200 feet per minute this operation being governed either manually or automatically.

Fig. 6 shows the driven-end of the same shafts.

Fig. 7 shows a "close-up" of the bearings supporting these shafts. You will note that the two "rollers" in each bearing rest in sockets in a "bearing bracket" that in turn is bolted to an alloy "pedestal" that goes down beneath the furnace hearth and is bolted to a ventilated I-beam. The "cover-plates" shown above the rollers are for the sole purpose of preventing large pieces of brick or scale from getting down into the

Fig. 6

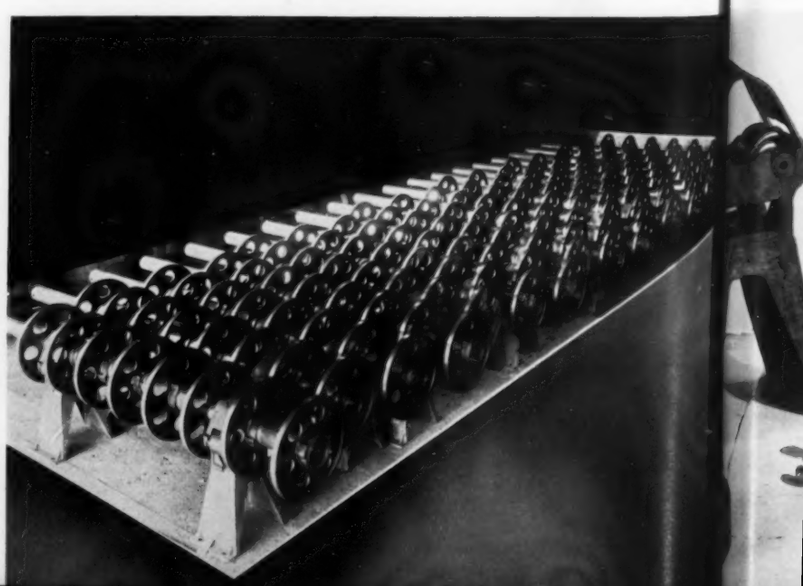


Fig. 7

bearing sockets. They do not prevent dust from getting into the bearings, in fact, present experience indicates the desirability of having this dust in the bearings as it consists largely of carbon and acts, at these temperatures, as an excellent lubricant.

You will note that the various parts of this bearing are simple, light and inexpensive. They can be assembled or disassembled with ease by the most indifferent mechanic and new rollers can be installed without removing the shafts. The cover-plates are pinned to the bearing bracket on one side only so that they can be tilted back out of the way with a bar when removing or installing a shaft.

Fig. 8 shows further details of the Inland bearings. On our next furnace we made slight changes mainly from the standpoint of attaining additional accessibility but the essential features of the design remain unchanged today.

Fig. 9 shows this furnace during construction. The shaft ends are shown passing through the wall on the drive-side as are also the flexible couplings, connecting the shafts to the driving mechanism.

Fig. 10 shows the interior of the Inland furnace during construction. The pedestals are shown coming up through the furnace hearth before grouting in, the two disc overhang on the driven end of the shaft is clearly shown as is also the very effective way in which one

Fig. 8

wall of the furnace is completely closed. Incidentally, this furnace is provided with a removable side-bung between each pair of buck-staves so that shafts can be removed from either side of the furnace.

Figures 11 and 12 show the charge and discharge ends of this furnace from the drive side. You will note how close to the wall the furnace is on the side opposite the drive, something that would not be possible with a series of outside bearings on this side of the furnace.

This furnace has now been in successful operation for two and one half years during which time it has turned out some 70,000 net tons of sheet and strip at a very low cost per ton for alloy and fuel and with very few shut-downs.

We have, of course, had some experiences in follow-

Fig. 9

ing this development through that have guided us in making further installations and some of these experiences brought to the front behavior of these alloys under these conditions and at these temperatures that were previously unknown and which might be interesting to review. Fortunately, the troubles that showed up were a long time in developing and were easily corrected.

After some six months of very continuous operation it developed that there were angular stresses in the bearing brackets that were hard to estimate and which were causing a slow spreading of the outer socket arms. We stiffened up the ends of these small brackets and supplied a new set to be installed whenever convenient. They were very gradually installed during production lapses and without removal of shafts over a period of some four months and in fact there are some of the original brackets still operating in the charge end of the furnace.

The most interesting failure occurred some months later when a shaft in the hottest zone sheared in half in the drive-side bearing. It was not noticed for some weeks that this shaft was broken, as the sheets tracked

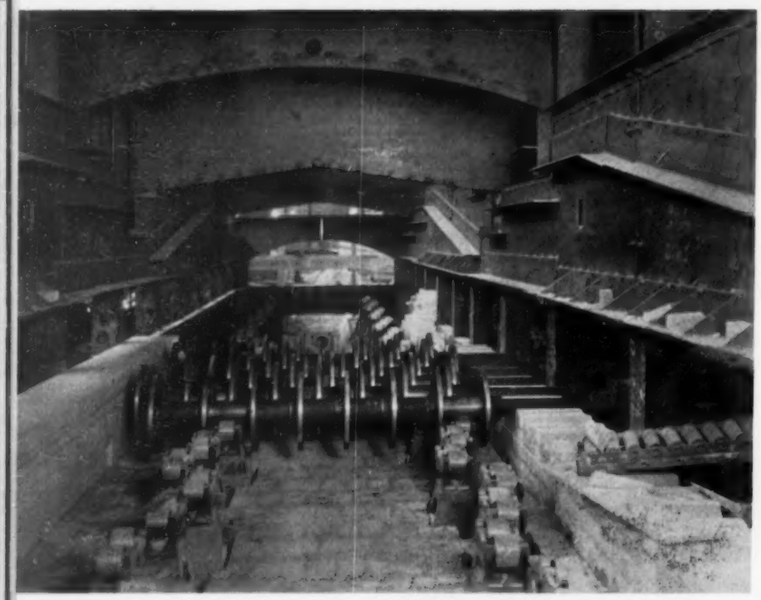


Fig. 10

through in perfect shape. The shaft had not sagged at all altho standing still for several weeks. However, when the shaft was removed it showed a very marked "cupping-out" of the inside at the point where it rested on the rollers, the outside diameter of the shaft remaining constant and quite smooth and round whereas the inside diameter increased so that the initial wall thickness was reduced by one half. The metal removed from this small cylinder over each bearing naturally flowed into length, giving us a total length of shaft considerably longer than that allowed for in expansion. This caused the sixth disc from the drive-end to rub on the far pedestal with increasing pressure until the shaft sheared off cleanly in the middle of the drive-side bearing where the wall section was already reduced by one half. The shaft was still supported perfectly and did not drop or sag but simply stood still. The effect was very similar to that obtained in the hot-rolling of seamless tubing and was not anticipated by us in our original designs.

The remedy was obviously to increase the wall thickness of the shaft for about six inches above each bearing. This has apparently solved the difficulty completely as none of the re-designed shafts have failed altho the first went in service some eighteen months ago. As a matter of fact a fairly good percentage of the original thin-walled shafts are still running in the charge end. The original shafts will prob-

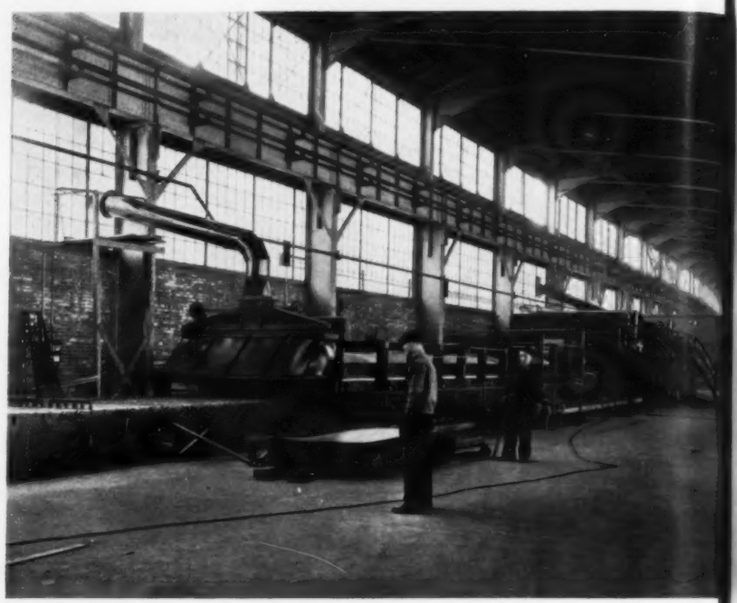
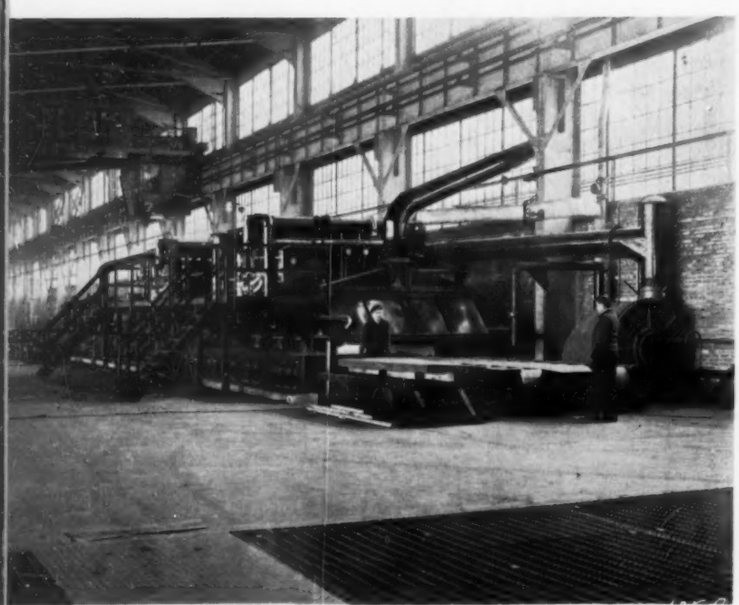


Fig. 12

Fig. 11



ably average better than eighteen months life so that the trouble could have been much more serious. It must, of course, be remembered that these shafts are comparatively light and inexpensive and that replacements can be made with an ease that is unfamiliar to those accustomed only to outside bearings.

Coming now to the bearing rollers, we had really anticipated that there might be enough wear on these to possibly limit their life to say two years and had designed them for low bearing pressures to make them last as long as possible. After nine months of operation, we removed the roller shown Fig. 13 from the hottest zone of the furnace and found no measurable wear on it.

The machined dimensions to which it was originally made were intact as far as an ordinary rule could determine. A micrometer might have revealed a few thousandths wear but we did not go that far. At the present time, after two and one half years operation of this furnace, only 21 rollers out of 152 have been replaced and these only because of casting defects that took a long time to show up and which we think we know how to correct.

The pedestals, of course, are under compression only, are comparatively cool and should have a long life. We have not yet had a case of trouble with them. And it is important to remember that they constitute at Inland about 15% of the weight of each shaft assembly which still further reduces the amount of alloy required per shaft when replacements are necessary.

The opportunities to compare the horsepower required to turn a shaft of this type as compared with an outside bearing shaft either water-cooled or non-cooled and at the same temperatures and loadings have been limited but it appears as if the inside bearing shaft will not require more than 10 to 15% more horsepower at the usual normalizing speeds of five to ten r.p.m. So that with a 10 h.p. motor driving the

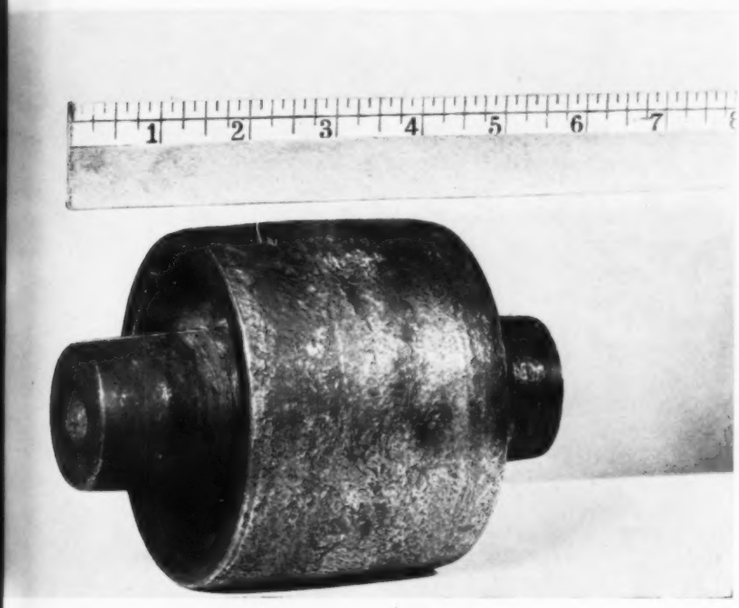


Fig. 13

average size of furnace this becomes a small item. We are gradually gathering data on the coefficients of friction at various speeds, loadings and temperatures and while not ready at this time to publish any definite figures on these we can say that the friction at these temperatures seems to follow at least two laws of cold friction, viz., that the coefficient of friction decreases markedly with increasing load and with increasing speed.

The fuel figures obtained on this furnace are unbelievably low, due, partly, we believe, to the tightness of the furnace and the reduction by one half of heat conduction through the walls by the shaft ends. Even including the alloy replacements already described the weights involved are so small, that after two and one half years, we are down to a figure on alloy cost per ton very close, indeed, to the best figures reported on chain furnaces at this temperature. The combined cost per ton here of alloy plus fuel, we believe to be lower than for any other type of normalizing furnace in existence today. This economy is coupled with a very high rate of production per square foot of hearth area.

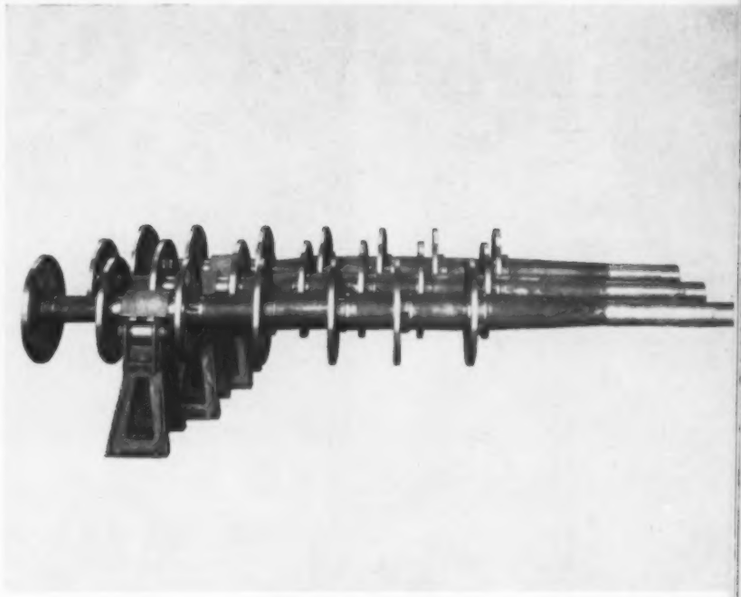


Fig. 14

Our second furnace of this type has been operating for the past ten months at the plant of the Granite City Steel Company, Granite City, Illinois. It is the same 7′ width as at Inland but shorter employing twenty five shafts in a 40′ heating zone. The design of these shafts is sufficiently different from the Inland shafts, to possibly warrant a few words regarding their details and why this design has progressed in the direction it has. In the Inland furnace, the projecting ends on the drive side of the shafts pass through asbestos stuffing boxes, are reasonably tight and, as mentioned before, there are only one half as many of them as would be required with outside bearing shafts. How-

Fig. 15

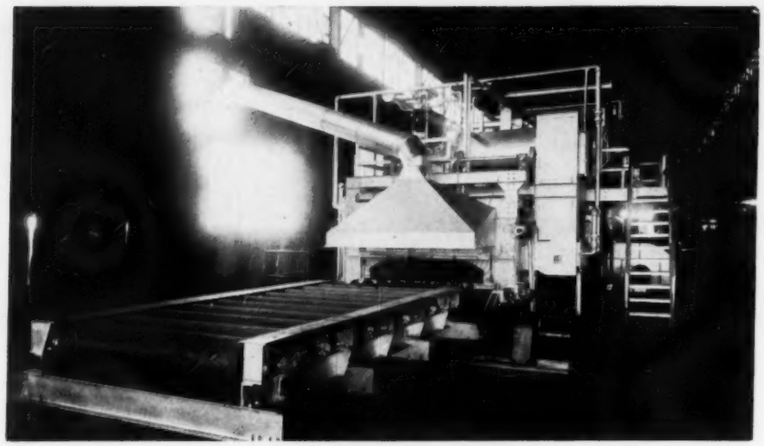


Fig. 16

ever, for various reasons it was desired to make the Granite City furnace completely tight at the side walls and it was therefore decided to use only one inside roller bearing, resting the outer end of the shaft in a swivel-type, lubricated bearing mounted on the outside furnace wall between buck-staves. These bearings are gas-tight.

Fig. 14 shows some of the Granite City shafts as shipped.

Fig. 15 shows the interior of the Granite City furnace during construction. The familiar two disc bearing overhang is shown on the inside end of the shaft and the swivel-type wall bearings are shown through the wall before bricking-in. There is no saving in alloy in this design over the Inland design as the longer span makes necessary a larger diameter of shaft which added weight just about balances the saving in the one bearing assembly. Both designs are now considered standard, the proper choice between them being based on the results desired.

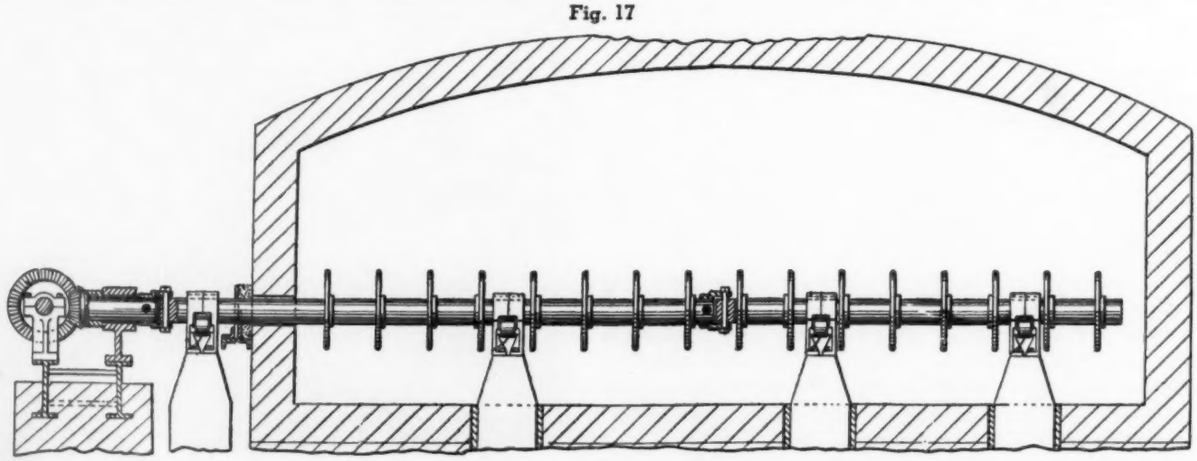
Fig. 16 shows the charge end of the Granite City furnace. A heavy oil is used for fuel here the same as at Inland gasification being accomplished in the combustion chambers shown on top of the furnace.

In adapting these shafts to old furnaces previously built, we can install ventilated I-beams beneath the hearth where the hearth has to be largely re-built anyway or we can rotate the pedestals from a vertical to a horizontal position, bring them thru the side-walls and bolt to steel channels welded between buck-staves, always with a large saving in weight of alloy and an improvement in furnace tightness and fuel consumption.

In concluding, let me point out the extreme flexibility of this design. It suffers from almost no limitations of furnace width, length or shaft spacing. A furnace 20′ wide could be easily constructed using about two 8′ shafts coupled together each on two bearings spaced about 50-60″ apart or we could get along with only three inside bearings and one outside bearing somewhat as shown on Fig. 17.

Other designs using very small shafts without discs, mounted about 6″ apart have been worked out for narrow strip, pipe, etc. in fact, as previously mentioned, the limitations imposed by furnace dimensions and loading are practically nil and we are almost always able to properly design the shaft with the low bending stress we believe it should have, insuring a conveyor that will ruggedly sustain the load with the driving power off and in addition will by reason of the tightness of the walls hold a pressure of reducing atmosphere which we believe must be reflected in the quality of the product.

Fig. 17



ROLLER BEARING APPLICATIONS

IN CONTINUOUS STRIP MILLS AND ROD MILLS

By S. M. WECKSTEIN, Ass't Chief Engineer
Timken Roller Bearing Company
CANTON, OHIO

Paper presented before the A. I. & S. E. E., Cleveland Section, February, 1935

▲ IN ORDER to best discuss this subject and to point out the various positions where roller bearings may be used in continuous strip mills, the writer has selected a mill recently designed and now being erected. This installation embraces a complete hot and cold strip mill. Figure I shows the arrangement of the hot strip mill which consists of the following major units:

1—44″ Blooming Mill
1—24″ x 56″ 2 High Scale Breaker
1—42″ x 96″ 2 High Broadside Mill
1—Vertical Edger
1—32″ x 56″ 2 High Roughing Mill
1—Vertical Edger
1—21″ and 46″ x 56″ 4 High Roughing Mill
1—Vertical Edger
1—21″ and 46″ x 56″ 4 High Roughing Mill
1—24″ x 56″ 2 High Scale Breaker
5—21″ and 46″ x 56″ 4 High Finishing Mills

The Cold Strip Mill has the following units:

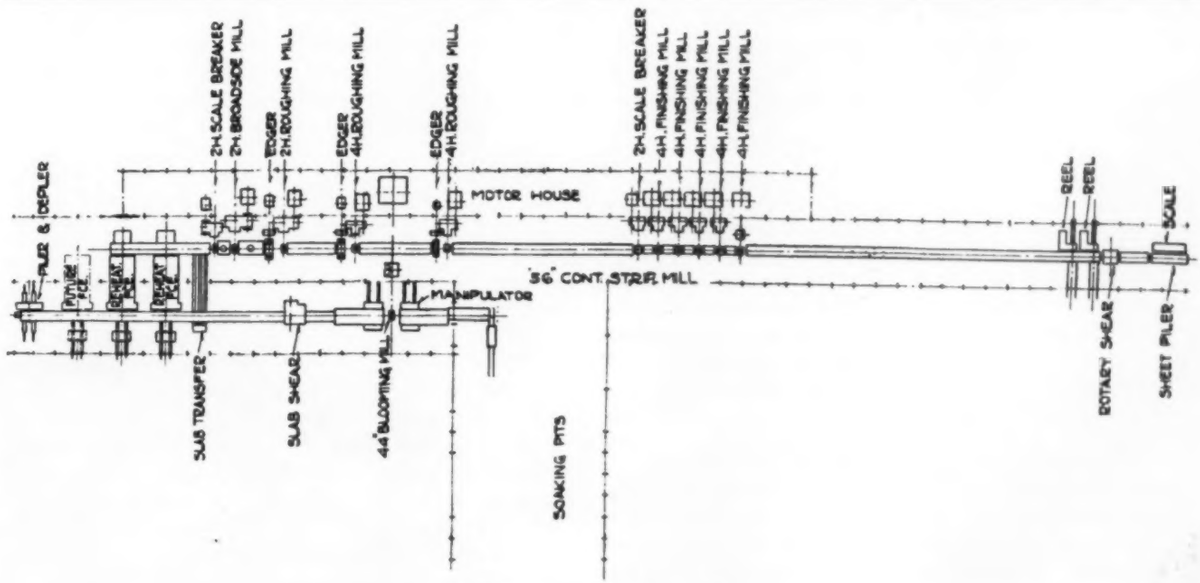
3—18″ and 49″ x 56″ 4 High Cold Mills
1—20½″ and 56″ x 84″ 4 High Cold Reversing Mill
2—27″ x 56″ 2 High Tempering Mills

These various mill stands are naturally provided with the necessary drives, tables, reels, uncoilers, shears and other auxiliary equipment.

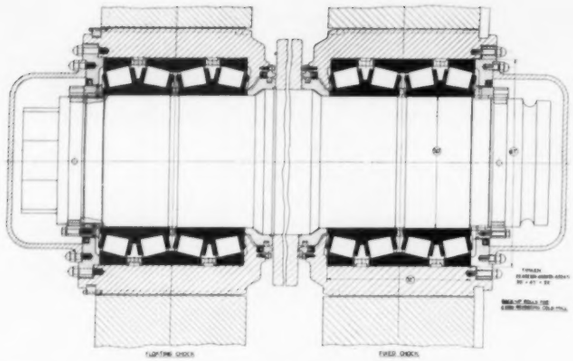
To visualize more easily the extent of this auxiliary equipment we have shown in Table I a grouping of the various units in which roller bearings are used. From this table we have selected one or more units from each group in order to show in detail how the bearings are applied.

Since the roll neck applications are very important, we have selected to show the design as used on the back up and work rolls of the 4 high mills and the roll necks of the 2 high mills and edgers.

Figure II shows the bearing arrangement used on the back up rolls of the 20½″ and 56″ x 84″ 4 High Cold Reversing Mill. The back up rolls of the 4 High cold and hot strip mills are similarly mounted. In all cases the bearings are supplied with cup and cone spacers to give a pre-adjusted bearing. The bearings are assembled in the chocks with the outer filler ring located between the bearing and outer closure. The entire unit is slipped on the roll neck and clamped in place by means of the standard split inner ring and threaded



(Fig. 1)—56″ Hot Strip Mill.



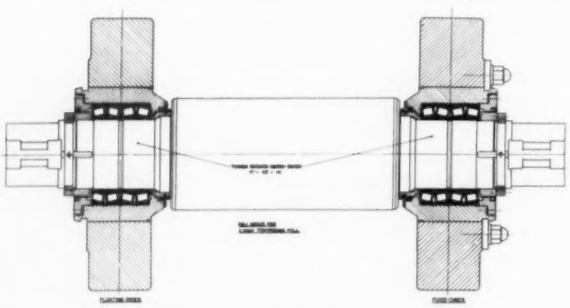
(Fig. 2)—Back-up Rolls for 4-High Reversing Cold Mill.

outer ring, which have successfully been used on previous installations.

The general design differs from previous jobs in two respects only. The inner filler ring instead of being loose and keyed to the neck is in this case shrunk on the neck and remains permanently fixed to the neck. For this reason the chock was designed with the extended inner portion which is very close to the inner race of the bearing and gives practically a sealed assembly when the bearing and chock are removed from the neck.

The closures are slightly different from those previously used. A piston ring is located in the filler ring and operates with the flinger which is bolted on to the chock. These two parts act as a baffle to the entrance of water and scale and protect the rawhide seal. This seal is of the dual type, having a straight leather disc and the standard type leather built into a unit. This unit is mounted with the lip of the leather pointing out in order to keep out any water which may get past the piston ring. The shape of the filler ring extension and that of the projecting portion of the chock form somewhat of a labyrinth, in which grease is trapped, and acts as an additional seal. At the opposite end a standard rawhide seal is used. This unit is mounted with the lip of the leather pointing in so as to reduce to a minimum the grease leakage from the chock.

The two chocks are exactly the same. When mounted in the mill housing, one chock is fixed by means of a clamp bolted to the housing. This locates the roll in the housing. The opposite chock is permitted to float to take care of expansion.

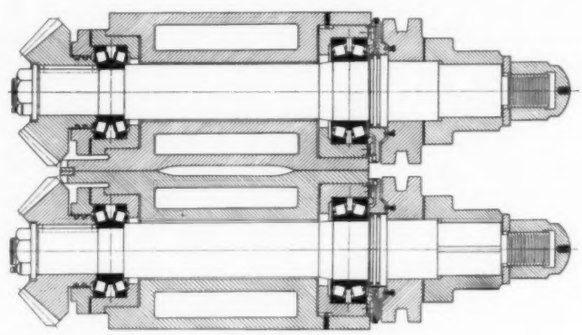


(Fig. 3)—Roll Necks for 2-High Tempering Mill.

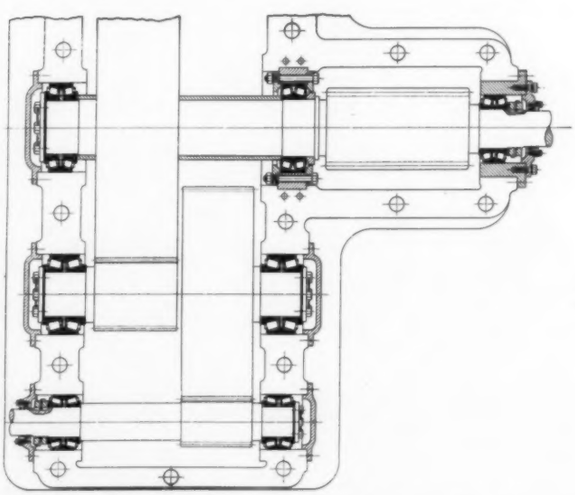
The work rolls on all the 4 high mills, both hot and cold, use a mounting which is really a miniature of the back up roll design. Here again cup and cone spacers are supplied with the bearings and the closure arrangement is the same. One of the bearing chocks is fixed to the back up roll chock while the opposite chock is permitted to float.

Figure 3 shows the bearing mounting on the roll necks of the 27″ x 56″ 2 high tempering mills. The general arrangement of closures, chock design and method of holding the bearings on the necks is exactly the same as in the case of the back up and work rolls of the 4 high mills.

Before leaving the subject of roll necks, the mounting of the bearings on the necks of the vertical edgers should be discussed. In this particular mill these rolls are mounted on cylindrical roller bearings. We have, therefore, taken the design as used on another mill. This is clearly shown in Figure 4. A double bearing is used adjacent to the edging roll. This bearing is mounted in a cartridge which floats in the housing. At the bottom of the roll spindle another double bearing is mounted in a cartridge which is bolted to the housing. These lower bearings position the main rolls and the bevel gears and carry all the thrust loads from gear and roll. Piston ring closures are used at the bottom bearings. At the top bearings, the closure is



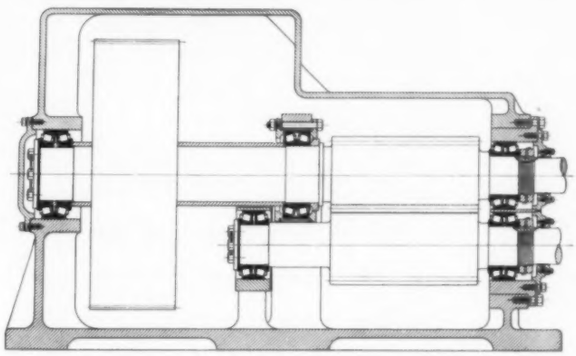
(Fig. 4)—Vertical Edging Mill.



(Fig. 5)—Combination Gear Drive and Pinion Stand.

made more positive in order to keep water and scale out of the bearings. This is accomplished by adding a wiping closure in the form of a circular dam. The bearings are mounted tight on the spindles since it is not necessary to remove them in order to change rolls. Bearing set-up is obtained by means of shims.

The 2-high scale breakers, 2 high broadside mill, 2 high roughing mill, 2 high tempering mills and all of the 4 high cold and hot mills with the exception of the last stand of the 4 high hot strip mill are driven by means of combination drives. Figures 5 and 6 are typical of the design and bearing arrangement as used on all of these drives. All the bearings used are of the two row type consisting of a double outer race and two single inner races butted together, or separated by means of a cone spacer, and ground to exact size to give the desired bearing set-up. Each outer race has a groove located in the center and running completely around the circumference. Four or more holes (depending upon the size of the bearing) are drilled to register in this groove. The circulating oil system is so designed that the oil enters the groove and holes in the bearing, spreads through the bearing and overflows from both sides to the sump in the gear case. The same oil is used to lubricate both bearings and gears. To assure that the bearings are never dry, especially at starting, an oil level is provided at each bearing. This is done either by bolting on or welding on plates, of desired height, to both sides of the housing at each bearing location.



(Fig. 6)—Combination Gear Drive and Pinion Stand.

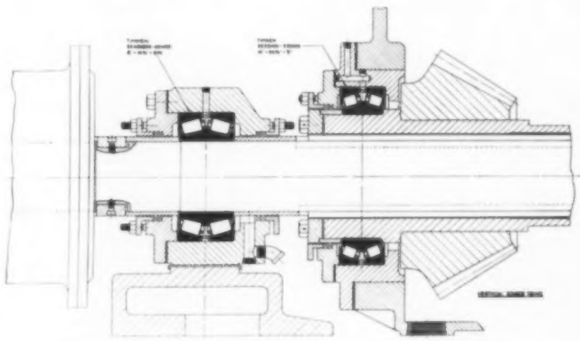
The bearings at both ends of the high speed pinion are of the same size and are permitted to float. The three bearings on the drive gear shaft are of different sizes. The two end bearings are permitted to float while the bearing in the center is fixed to positively locate the gear shaft and to take care of the mill thrust if there is any. The two bearings on the lower mill pinion are the same size and both float.

The last stand of the 4 high hot strip mill is driven direct from the motor through a pinion stand. The bearings used here are of the same general design as those used on the bottom pinion of the combination drives shown in Figure 6. The lubrication is accomplished in the same way. Here again provision is made to maintain an oil level around the bearings by means of bolted on plates and projections on the housing. The bearings used are all of the same size.

The arrangement of the drive for the vertical edgers is shown in Figure 7. The drive comes in through the coupling at the left hand end of the shaft which is supported by the two row tapered roller bearing as shown. At the opposite end of this shaft a cylindrical roller bearing is used. On this shaft is located a splined sleeve which carries the bevel pinions which mesh with the bevel gears on the vertical edging rolls. Suitable arrangement is made to move the sleeve along the shaft for the proper setting of the edging rolls.

The tapered roller bearings which are shown are supplied with cup spacers ground to give the desired set-up. The bearings are positively located both on the shaft or sleeve and in the housings. They carry all the thrust load from the bevel gears as well as their portion of the radial load. The lubricant is supplied as shown to the center of the bearing. Proper closures are used to keep the lubricant in and foreign matter out of the bearings. The design is arranged so that a definite oil level is maintained at the bearings at all times.

The drive for the pinch rolls of the flying shear is interesting because of its simplicity. Figure 8 shows the arrangement. Single row bearings are used in all six positions. Bearing set-up is obtained by means of shims between the cup followers and housing. Set-up of the 45 degree spiral gears is obtained by shifting shims from one side to the other. It should be noted that the housing is split at center line of the top and bottom gear shafts. The gears and bearing inner races are assembled on the shafts on the bench. The outer races and bearing followers are added at time of final assembly in the case. The housing is not split at the drive shaft. The bearing at the extension end of the shaft is, therefore, mounted in a carrier, the outside diameter of which is such that the spiral gear, assembled on the shaft, can be entered through the opening in the housing.



(Fig. 7)—Vertical Edger Drive.

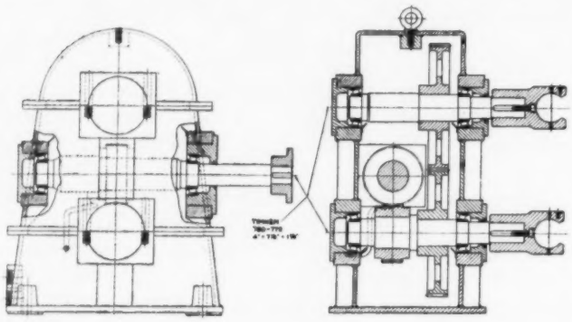
To take care of lubrication it will be noted that baffles are provided. At the drive or center shaft, these baffles are provided on top so as to catch the spray from the top gear and housing walls and lead the oil to the bearings as shown. At the upper and lower shafts the baffles are arranged so as to best catch the spray and lead it to the bearings.

The screwdowns on the 44″ blooming mill, on all the 2 high mills and on the 4 high mills are equipped

with roller bearings. The bearing mountings employed are combinations of the various mountings shown for the drives previously discussed.

All of the various table rolls on this mill are equipped with roller bearings. Some of the rolls have tapered roller bearings at both ends. The large table rolls, however, are designed as shown in Figure 9. Here a two row tapered bearing is used at the bevel gear end and a cylindrical roller bearing at the opposite end.

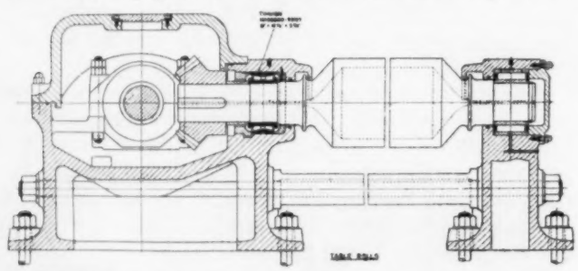
In previous designs it has been the practice to use cylindrical bearings or plain bearings at both ends. To take care of the thrust, a bronze horse shoe collar was used between a shoulder on the roll and the housing. When it was necessary to remove a table roll the bronze horse shoe collar was slipped out and the roll pulled endwise until the gears were disengaged sufficiently to permit lifting the roll out.



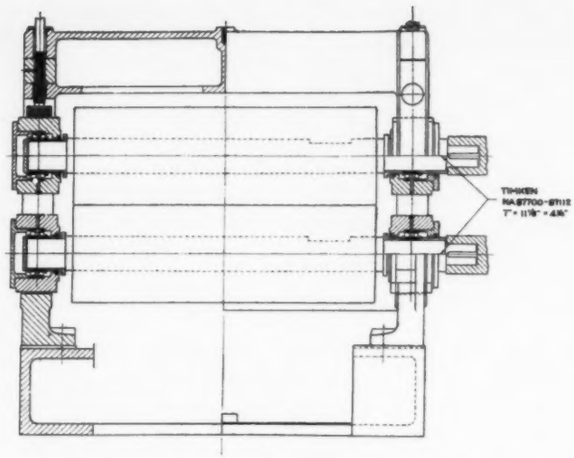
(Fig. 8)—Pinch Roll Drive for Flying Shear Drive.

In this new design the same thing is accomplished in a rather unique way. The bearing adjacent to the bevel gear is mounted direct in the main girder and in a cap bolted to it. The bearing is clamped on the roll neck through the gear and in the housing by means of two specially designed rings. The inner or right hand ring is split on the center line. The upper half is bolted into the cap while the lower half rests in the housing. The outer or left hand ring is made in one piece and is machined with a projection half way around its circumference. This projection fits into a groove machined in the girder. The opposite end of the roll is mounted on a cylindrical bearing. The diameter of the inner race of the bearing is made equal to or slightly larger than the diameter of the adjacent shoulder on the roll. This bearing floats to care for expansion of the roll.

When it is desired to remove a roll from the table, the following procedure is followed. The cap at the



(Fig. 9)—Table Rolls.

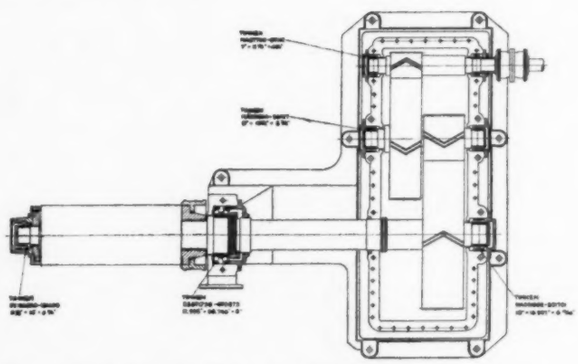


(Fig. 13)—Pinch Rolls for Drum Type Flying Shear.

tapered roller bearing is removed. This takes with it the upper half of the inner split ring. The outer ring is rotated 180 degrees so as to disengage it from the groove in the girder. This allows some freedom in the girder and makes it possible to push the lower half of the split inner ring around until it can be lifted out. With this inner ring out of the way the roll can be slid endwise sufficiently to permit of lifting it out.

Figure 10 shows the driving arrangement and a general view of the shear approach table.

Figure 11 shows an extension of the furnace table with the cover removed to show the lineshaft and table roll drive arrangement.



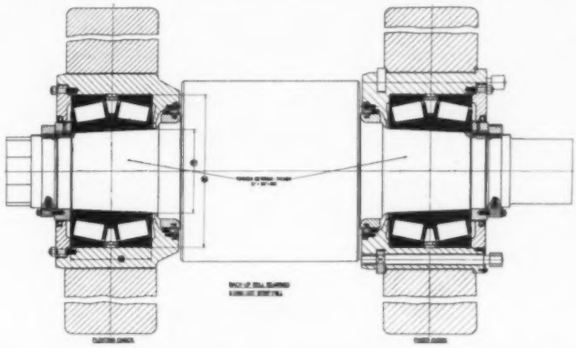
(Fig. 14)—30″ Drum Drive for Cold Strip Reel.

Figure 12 shows a completely assembled section of the Furnace approach table.

The design of the pinch rolls for the flying shear is shown in Figure 13. This design is also typical of other pinch rolls used in the mill. Two row bearings consisting of a double outer race and two single inner races butted together are used at each end of the neck. The bearings are clamped on the necks through the couplings or by means of plates bolted on as shown. Pullers are incorporated to assist in the removal of the bearings when necessary. All bearing boxes are sealed by means of rawhide seals. Lubrication is provided

through inlets which register with the grooves and holes in the outer race.

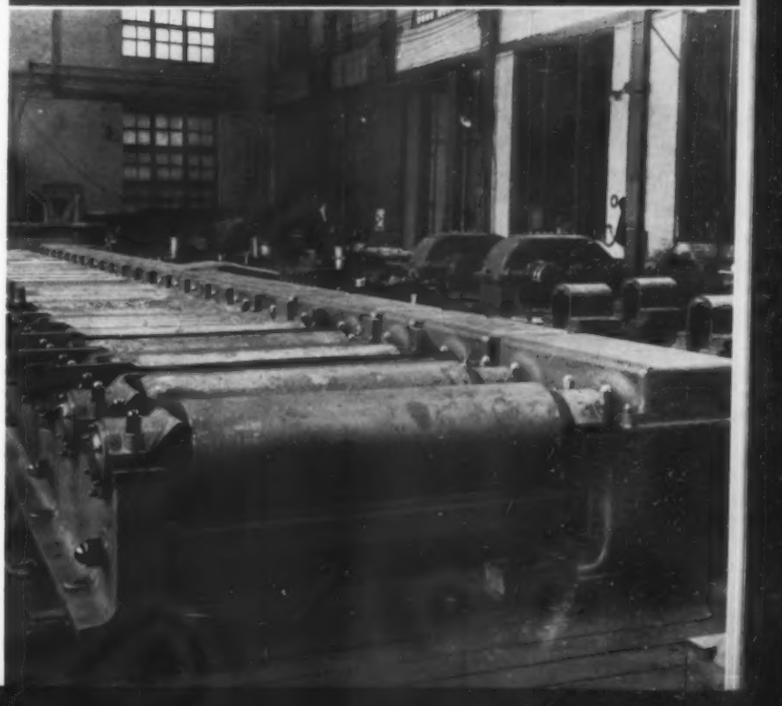
Figure 14 illustrates the design of the reels. The bearings in the drive are mounted in the same manner as those in the standard drives previously described. The large bearing which carries the heavy drum load is fixed and locates the low speed shaft of the drive. All the other bearings in the drive are permitted to float. The bearing at the outboard end of the drum is mounted in the same manner as the large bearing. This design is similar to the designs which have been used for quite a number of years in other mills.



(Fig. 15)—Back-up Roll Bearings—4-High Hot Strip Mill.

The preceding illustrations complete the typical design selected to feature the bearing applications used in 4 high strip mills and auxiliary equipment. Before leaving this subject and proceeding with other types of mills, it will be interesting to study another back up roll bearing design which is being installed on a mill now being designed. This is a 21″ and 45″ x 43″ 4 High Hot Strip Mill to operate at a delivery speed of 2000 feet per minute. Because of the high speed on the back up rolls it was feared that the loose fitted bearings would creep excessively and after a short time would cut the necks to a point detrimental to the efficiency of the mill. For this reason the design shown in Figure 15 was adopted. Here a heavy duty two row cup adjusted bearing is used. The inner race of this bearing has a tapered bore and fits on a corresponding taper on the neck. The bearing is held on the neck by means of the conventional type of locking arrangement used with the standard design. The closure design is also the same as previously described.

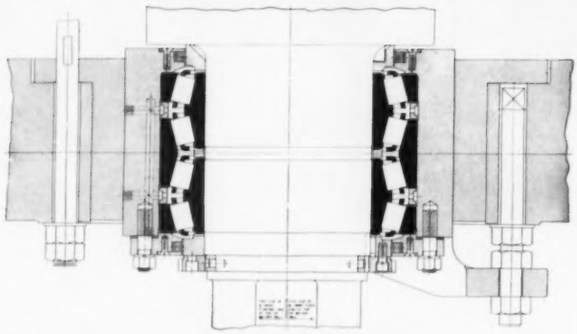
To assemble the bearings on the necks, it is suggested that the bearing and chock assembly be warmed slightly by submerging the unit in hot oil. The assembly can also be made cold if preferred. It is important that the assembly be pulled up tight on the taper. To remove the bearings from the neck either steam or hot oil can be used. The grease is first flushed out and the steam or hot oil introduced through the



Top—(Fig. 10)—Driving Arrangement of Shear Approach Table.

Middle—(Fig. 11)—Extension of Furnace Table with Cover Removed.

Bottom—(Fig. 12)—Furnace Approach Table Assembled.



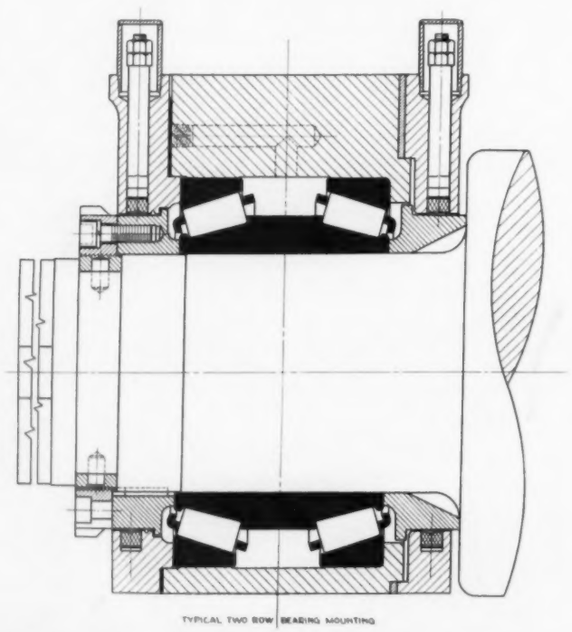
(Fig. 16)—Floating and Fixed Ends of Rolls.

lubricant connection. It is important that tension be imposed on the assembly at the same time. This can be accomplished by driving a wedge between the bearing chock and roll body. In a steel plant where the same design is used, with slightly smaller bearings, the above described procedure has been successfully used for a number of years.

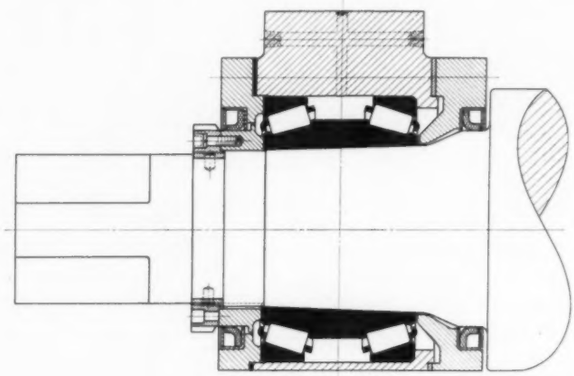
At the annual meeting of the Association in September 1934, the writer presented a paper on "Precision Rolling Mills." This paper was printed in full in the November 1934 issue of the Iron and Steel Engineer. In view of this we will not go into great detail, but will merely illustrate a few suggested methods of mounting bearings on rod mills and means for obtaining accurate roll setting.

Figure 16 shows a typical method of mounting the bearings on the roll necks of a 2 or 3 high bar mill. The general assembly is the same as that described for the roll necks of the 4 high mills. Each roll has a fixed and a floating chock. The design on the right of the center line shows the construction of the fixed chock. The special flange shown is used for locating the roll and also for obtaining pass alignment. The left hand design shows the construction of the floating chock which is the same as that of the fixed chock except that the flange has been eliminated.

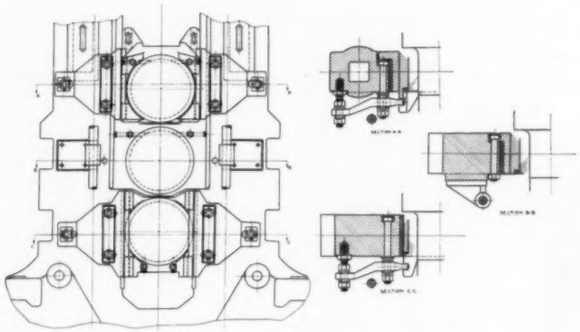
On smaller mills operating at higher speeds, in order to reduce roll neck wear, the races are fitted tight to the necks. Figure 17 shows such a typical two row mounting although the same principle of mounting can be used with four row bearings. To provide for easy removal of the bearings, the boxes are made so



(Fig. 17)—Typical Two Row Bearing Mounting.



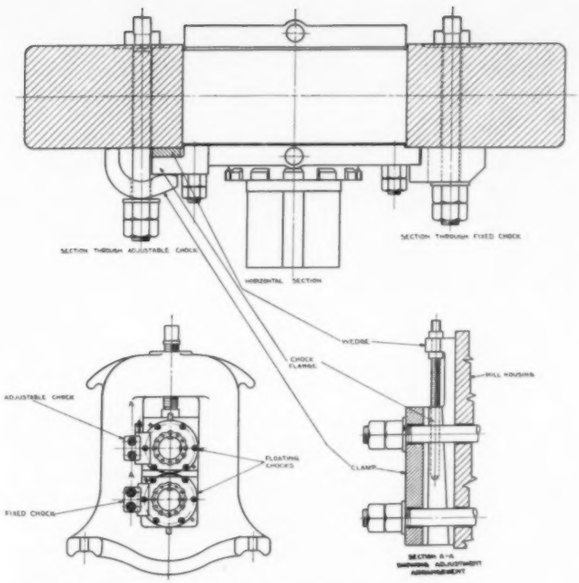
(Fig. 18)—Typical Mounting for High Speed Mill.



(Fig. 19)—

that the inner closure plate is a separate piece. The inner filler ring is provided with a shoulder. A special split plate from $\frac{1}{8}$ to $\frac{3}{16}$ inches thick is used between the bearing box and inner closure. To remove the bearings this split plate is removed and the inner closure is drawn up tight to the bearing box, thus bringing the closure plate in contact with the shoulder on the filler ring. By applying pressure to the closure plate, the entire assembly is very easily removed. In reassembling the bearings on the neck, it is recommended that the assembled bearing and chock be heated in oil at about 300 degrees Fahr. and slipped on the neck as a unit.

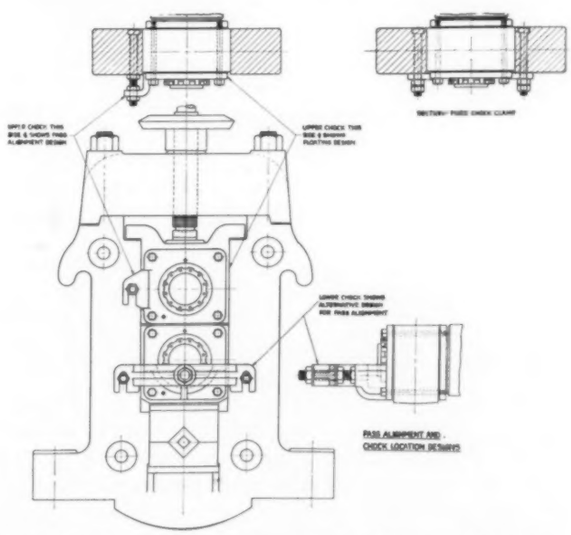
Another deviation of the two row mounting is that shown in Figure 18 where a tapered bore cone is used. Here the same scheme of bearing removal as described for the preceding design may be used. It is quite possible, however, that in the majority of cases, this bearing assembly can be removed from the neck merely



(Fig. 20)—Scheme Using Wedge Arrangement.

by wedging between the roll body and chock and by hitting the neck with a hammer blow.

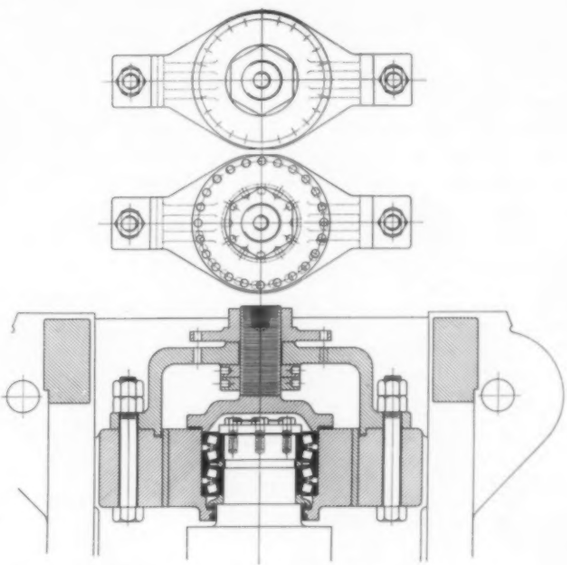
To obtain proper alignment of passes on rod mills, various schemes have been used. Figure 16 showed a flange extending from the bearing box. By means of a push and pull bolt and nut arrangement working with this flange, proper roll setting is obtained. Another successfully used scheme is shown in Figure 19. The top and bottom roll bearing boxes on one side of the mill are provided with lugs in which slots are machined. Special clamps fitting into these slots are bolted to the mill housing. By means of ball seats, special washers and push and pull nuts, the boxes can be moved in or out to align the passes. It is recommended that the ends of the clamps be hardened and the faces of the slots be lined with hardened inserts.



(Fig. 21)—Pass Alignment and Chock Location Designs.

Figure 20 shows a scheme using a wedge arrangement. The wedge is inserted between the mill housing and a special flange on the bearing chock. The flange is bolted to the mill by means of a special clamp. By loosening the nuts holding the clamp, the wedge can be adjusted in or out to give the desired roll setting.

In some cases it is inconvenient to get to both sides of the bearing chocks as would be required to adjust the push and pull bolts, clamps or wedges. To get around this the design shown for the lower chock of Figure 21 can be used. Here a flange is used on the vertical center line of the bearing chock. A bracket is bolted to the housing and located so that a bolt which is fixed to the chock flange passes through the center of this bracket. Nuts are located on the inside and outside faces of the bracket so that by manipulating these nuts the bearing chock and consequently the entire roll can be moved in or out to lign up the passes.

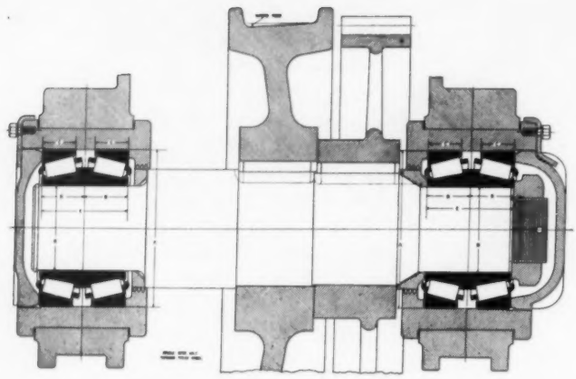


(Fig. 22)—Adjustment on 11″ Vertical Mill.

Another central type of adjustment is that used successfully on vertical mills. Figure 22 shows the top bearing closure designed with a threaded extension. By means of a specially designed threaded plate, a special bracket bolted to the mill housing, and jam nuts, the entire roll assembly can be lifted or lowered, as required, to obtain the proper alignment of the passes. To more closely control the increment of adjustment, the threaded plate and the bracket have a number of drilled holes arranged so that these holes are equally spaced but are different in number. The adjustment can, therefore, be locked by mating up any two holes and inserting a pin through them.

This paper would not be complete unless some mention were made of crane design. We have selected two points of application which are particularly suited to the use of tapered roller bearings.

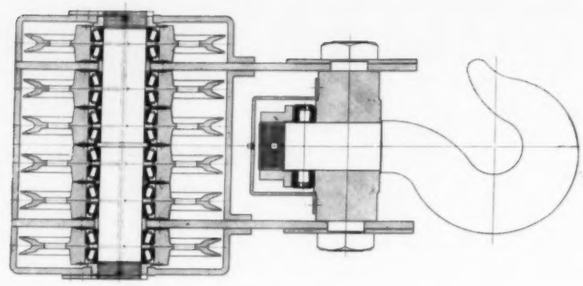
Figure 23 shows the design of a bridge drive axle with tapered tread wheel. That this type of wheel has come to stay is a pretty well accepted fact. The bear-



(Fig. 23)—**Bridge Drive Axle Tapered Tread Wheel.**

ing arrangement as shown ideally handles all loads which result from this design. Two bearings are used in each box which is bolted securely to the main frame. The bearing at one end is clamped against a shoulder on the axle. At the opposite end the bearing is unclamped to take care of variations in machining and expansion. A safety wire is used on the axle to assure that the bearings will not come off accidentally. Set-up of the bearings is obtained by means of the threaded end caps which are securely locked in place.

The hook block layout shown in Figure 24 is another crane application which is receiving a great deal of interest. The bearing outer races are fitted tight in



(Fig. 24)—**Hook Block.**

the sheaves. The inner races being mounted on a stationary shaft are fitted loose. In this way the assembly can be very easily made. It will be noted in this design that the shaft is shouldered in the middle and the sheave bearings on either side of the shoulder are all set up from the one nut which is securely locked. Variations of this arrangement can be successfully used. With this design the spacing of the sheaves is permanently maintained and excessive rope wear eliminated. Lubrication is accomplished by proper drilling of the shaft as shown.

There are other units encountered in mills which might be discussed. It is felt, however, that the designs which have been shown are typical enough to cover the majority of applications.

▲ ▲ ▲ Association Activities ▲ ▲ ▲

PITTSBURGH SECTION

H. G. R. Bennett, Chairman — C. H. Hunt, Secretary

Cardinal Room, William Penn Hotel
Friday Evening—8:00 P. M.
November 8th, 1935.

"The Application of Oil Electric Locomotives to Steel Mill Operation" by A. H. Candee, Transportation Department, Westinghouse Electric and Manufacturing Company, Philadelphia, Penna.

CHICAGO SECTION

H. G. Hague, Chairman — A. J. Whitcomb, Secretary

Phil Smidt's
Wednesday Evening
November 6, 1935
Dinner—6:30 P. M.

"Speed Regulation of Direct Current Motors" by C. Lynn, Design Engineer, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Penna.

PHILADELPHIA SECTION

M. J. Conway, Chairman — L. O. Morrow, Secretary

Dinner 6:00 P. M. — Engineers' Club—1317 Spruce Street — Meeting 7:00 P. M.

Saturday Evening
November 2, 1935

"Designing for Lubrication" by C. R. Hand, Lubricating Engineer, Bethlehem Steel Company, Sparrows Point, Maryland.

CLEVELAND SECTION

J. H. Barse, Chairman — W. W. Spanagel, Secretary

Cleveland Engineering Society—Friday, November 1, 1935

"Electric Control Systems for Continuous Strip Pickle Lines" by J. J. Mellon, Engineer, Clark Controller Co., Cleveland, Ohio.

BIRMINGHAM SECTION

J. B. Looney, Chairman — B. Thele, Secretary

Meeting will be announced later.

STEEL IN FEDERAL PROJECTS

BILLION DOLLARS FOR STEEL AND ALLIED PRODUCTS

By EDWARD H. FOLEY, Jr., Director Legal Division
Public Works Administration
WASHINGTON, D. C.

Paper presented before the A. I. & S. E. E. Convention, Pittsburgh, Pa., September 24, 25, 26, 1935.

EDWARD H. FOLEY, Jr. addressing the Society, September 26, 1935.

▲COLONEL HACKETT was unable to leave Washington to address the members of this Association due to the extraordinary demands which have been made on his time by the departure of the President and Administrator Ickes for the West, a fact which he, of course, was unable to foresee at the time he accepted the honor of addressing you. I know he had been looking forward to this occasion when, as he put it to me, he would have an opportunity to talk to a group representing one of the major industries of the nation about the purposes and achievements of the Public Works Administration. The honor you gave him he has reluctantly passed on to me. I am indeed happy to have the privilege to speak in his stead to the members of the Association of Iron and Steel Electrical Engineers.

As you know, the Federal Emergency Administration of Public Works was established a little more than two years ago under Title II of the National Industrial Recovery Act. All of its powers were to be exercised by an Administrator charged with the duty of preparing, under the direction of the President, a comprehensive program of public works. To administer the public works program the President selected the Secretary of the Interior, Harold L. Ickes. By Executive Order the Administrator was authorized to extend aid, by way of loans and grants to public corporations and by way of loans to private corporations, in financing the construction of projects included in the comprehensive program. The Administrator was also authorized to make outright grants to other Federal agencies for the purpose of constructing Federal public works projects. The Emergency Relief Appropriation Act of 1935 continued the Public Works Administration until 1937 and authorized PWA to perform such additional functions under this new works bill as the President might delegate to it.

The original PWA program was undertaken by an organization new to the job and without the benefit of previous experience in carrying out a vast program of public works. With the exception of some huge projects involving the expenditure of many millions of dollars which will take two or three years to complete, most of the projects for which allotments were made under the original program will have been completed by the end of the current construction season. These projects involve expenditures of public works funds approximating $2,850,000,000. Of this sum it is esti-

Millions of feet of cable wire make the spans from which will suspend the Triborough Bridge connecting Manhattan, Bronx and Queens Boroughs.

mated that one billion dollars will be spent for products of the steel and its allied industries. This estimate is based upon a breakdown made by the Bureau of Labor Statistics of more than a billion and a half dollars worth of public works projects for which contracts had been let and materials ordered in the early summer of this year. Forty percent of this billion and a half went for labor at the site of the project, and the rest for materials. Twenty-four percent of the expenditure for materials went directly for iron and steel and allied products, excluding machinery and transportation equipment. Twenty-eight percent of the material orders went for machinery and transportation equipment. More money was expended for structural and reinforcing steel than for any other class of material employed on public works projects. About eight percent was spent for miscellaneous nonferrous metal products, and iron and steel equipment in addition to that already mentioned.

If the percentages established by the breakdown made by the Bureau of Labor Statistics hold good for the entire program (and I see no reason why they should not) the ultimate expenditures under the original public works program for metal products will be as follows:

400 million dollars for iron and steel and their products—excluding machinery and transportation equipment.

320 million dollars for machinery, not including transportation equipment.

150 million dollars for transportation equipment.

130 million dollars for nonferrous metal products and miscellaneous items, all of which total one billion dollars.

The expenditures made for iron and steel products alone will approximate three quarters of a billion dollars. These figures establish beyond a shadow of a doubt that the PWA program has benefitted immeasurably your industry.

While these figures are illuminating, nevertheless the real significance of the public works program to the capital goods industries of America—especially to the steel industry—cannot be told from figures alone. To men like yourselves whose primary interest is not so much in immediate sales as it is in the progress of your industry and the expansion of the market for your products there are other things of equal importance. For instance, a billion dollars spent on metal products for carrying on a war would appear the same on the year's balance sheet as the expenditure of a like sum for steel products in connection with a public works program. Instead of providing a guarantee for future sales, however, such an expenditure for war materials would destroy both resources and potential customers. On the other hand, the expenditure of an identical amount through the Public Works Administration is actually resulting today both in an increase in national wealth and the creation of new markets for steel.

In part these results are being accomplished through financing the construction of 576 million dollars worth of roads and highways. Not much steel or iron is used directly in these roads, but indirectly their construction is of enormous importance to you. After all, the prosperity of the steel industry depends to a large extent on the automobile industry and the extensive use of automobiles depends upon the existence of a far flung network of paved streets and highways. Only with such a system of good roads can the advantages of automobile transportation be fully realized and the demand for automobiles be correspondingly maintained.

In addition, PWA is aiding in the construction of numerous modern fire-proof courthouses, city halls and schools in all parts of the country. We are advancing some 540 millions for such buildings. Of this amount more than one-third will be devoted to buildings for educational purposes, and about one-sixth to municipal buildings. Huge amounts are also being expended for steel bridges and viaducts. This construction will naturally increase the physical assets of the various communities and must inevitably be accompanied by an increased civic responsibility and a strengthened quality of citizenship.

Furthermore, PWA is aiding in the construction of 350 million dollars worth of public service enterprises. More than half of this amount is for sewer projects and about one-third for water systems. Over a third of the money spent for materials on sewerage and waterworks projects is for cast iron pipe and fittings. Twenty-seven millions of this 350 millions is for electric power projects (excluding water power). Again, the actual capital outlay is negligible compared with the ultimate expend-

itures for fixtures, connections and appliances which will be entailed and which will directly benefit the metal trades.

We are also spending nearly 287 millions for the development of water power through the construction of dams and power plants and projects for reclamation and flood control. This sum will eventually transform large sections of the country from stricken relief areas to prosperous self-supporting regions thereby increasing purchasing power and creating additional markets.

Some of these dams are among the most gigantic projects now under construction in this country. They supply invaluable proving and testing grounds for technological invention and for the use of the best brains that the industry can produce. Among the larger projects being financed by PWA should be included the Triborough Bridge in New York, to cost 44 millions, the Chicago Sanitary Sewer System, to which 59 millions has been allotted, the Loup River and Platte Valley power and irrigation projects in Nebraska, involving the expenditure of more than 18 millions, the Mid-Town Hudson Tunnel in New York to cost more than 24 millions, the Casper-Alcova dam in Wyoming, to cost 20 millions, the Grand Coulee and Bonneville dams in Washington and Oregon, to cost 100 millions and the Ft. Peck dam in Montana to cost 86 millions. In addition to these projects, approximately 238 million dollars of Public Works funds was allotted to the Navy Department for the construction and outfitting of 32 naval vessels. Loans to railroads have also been made amounting to $210,000,000 to finance the purchase of rails, cars, equipment and for electrification and other improvements. To this list must be added the road and bridge program of the Allegheny County Authority to be undertaken in Pittsburgh and vicinity, for which an allotment of $24,500,000 has been made. As I have before pointed out, a huge share of these millions goes to pay for the products of your industry.

So far I have discussed only the advantages accruing to the metal industries from our expenditures for materials. Equally important is the matter of wages. It is a well-known fact that on all PWA projects prevailing wage rates are paid. This has an important bearing on the metal products industries, inasmuch as decent wages maintain the American standard of living and increase the purchasing power of our citizens. It is not an accident that the steel industry is often accepted as an index of general business activity and relative prosperity. In this day and age, an index of the consumption of metal products would be one of the best possible gauges of the level of purchasing power.

At this point I should like to direct your attention to a matter which is of vital importance to your industry and concerning which much misinformation has been spread. This matter is the effect on your industry of the domestic materials order recently promulgated by the Public Works Administration. Hundreds of inquiries have been received by us from persons associated with the steel industry asking for an explanation of the order.

This regulation constitutes a new requirement only to the extent of the preference for American materials. The Public Works Administration has always required borrowers and grantees of Public Works funds to advertise for bids for the purchase of materials and to award the contract to the lowest responsible bidder. Until the issuance of the domestic materials order, there was no regulation giving any advantage at all to American made materials on non-Federal projects.

Lights and shadows give the Triborough Bridge tower a modernistic touch. This PWA project is designed to relieve rapidly increasing traffic.

Therefore, since the vast majority of PWA construction is done under contract for which the order does not require foreign materials to be purchased, and since our recent regulation gives an advantage to American materials which has heretofore not been afforded them by PWA regulations, I do not see how our regulation can injure American labor and industry at all, and I believe its effect has been much misunderstood and misrepresented.

PWA has demonstrated that a public agency, with billions to spend all over the nation, can work efficiently, without graft and waste, in the public service. The old public works program was hindered to some extent by legal difficulties arising from the presence on the statute books of the various States of a great body of antiquate municipal law—law which had been written not to facilitate, but to prevent public bodies from borrowing and building. It was the task of our lawyers to assist in rewriting and reshaping this great body of law for adaptation to the swiftly moving needs of modern municipal life.

This task has been accomplished with a large degree of success. Much of the cumbersome and detailed

procedure for issuing municipal bonds has been simplified. Legislation has been enacted in most States authorizing municipalities to finance the construction of revenue producing improvements by the issuance of obligations payable from the revenues derived from such projects, rather than from taxes, thus eliminating the objections usually made by over burdened tax payers to needed municipal improvements. The creation of new types of public corporations has also been suggested, designed to avoid constitutional and statutory debt and tax limitations.

These changes in the law, which I have outlined only in the barest detail, have greatly reduced the time in which municipalities can get projects under construction. The time required for getting projects under way has been further reduced by decentralization of the Public Works staff. The original program was carried on primarily from Washington, where a highly trained technical staff was centralized. The new program will be carried on primarily from the field, under the supervision of State Directors, who will have the benefit of advice from the trained staff which has been sent out from Washington to the State offices. The decentralized staff will thus be able to work in closer cooperation with applicants in various States and their authorized representatives.

Before PWA makes a loan to a non-Federal governmental agency or to a private corporation to aid in financing a public works project our lawyers pass upon all legal matters incident to the issuance and sale of the obligations offered as security for such loans to the end that the Government will receive legal and binding obligations in return for all of its loans. Our finance division studies the financial history of each applicant, its debt record, its burden of debt and taxation, its tax collections, and from these data reaches a conclusion as to the applicant's capacity to repay the loan. Care is taken to buy bonds which may readily be resold in the private investment market as rapidly as conditions permit.

In addition to a study of its legal and financial aspects, each project is carefully studied by the Engineering Division from the standpoint of its technical soundness and its social and economic desirability.

Congress has wisely afforded PWA the nucleus of a permanent Public Works Program by providing that the proceeds from the sale of obligations taken as security for loans may be used for making additional loans for Public Works projects. PWA has already purchased more than $400,000,000 bonds of non-Federal agencies and is under contract to purchase approximately $275,000,000 more. An additional $200,000,000 of equipment trust certificates has been acquired from approximately twenty railroads. Of the obligations which we have taken as security for loans we have sold or have contracted to sell more than $350,000,000 and all of the money thus realized has been used or is available for additional loans.

The Public Works program under the $4,000,000,000 Work Relief Bill of 1935 has, of course, not yet progressed to the point where it is possible to evaluate with any degree of accuracy the extent of the part which will be played by PWA. The experience of the Federal Government in the new works program has, however, conclusively demonstrated that the Nation as a whole is definitely convinced of the value of a sound public works program. This is evidenced by the fact that during the short time in which applications were permitted to be filed, more than 12,000 applications for aid in financing projects, costing in excess of $3,000,000,000 were received by PWA. It should be remembered that each of these applicants volunteered to bear 55% of the cost of the project.

Among the many allotments for public improvements is the lower illustration showing construction progress on Lock No. 7 in Dresback, Minn.

The necessity for speed in putting to work the 3,500,000 unemployed people on the Federal relief roll has required a selection from among these 12,000 projects of those which will meet the standards set up by the President, namely, that each project be under construction by December 15 and be capable of being completed within a year, that it be located in a region where relief labor is available, and that the average cost to the Federal Government should not exceed $850 per man per year.

Of all of the activities of PWA, the work of the Housing Division has been closest to Colonel Hackett's heart. The Housing program has been impeded by litigation and the pioneering nature of the work. The original schedule called for substantial completion of 64 projects during 1936, in addition to eight projects which are now nearing completion. Seven limited dividend housing projects are al-

ready built and occupied. These projects are located in New York City, Philadelphia, St. Louis, Euclid, Ohio, Raleigh, North Carolina and Alta Vista, Virginia. Because of the need for speed, which I have just mentioned, it will be necessary to curtail this important housing program.

Only recently Administrator Ickes submitted lists of selected projects to the President for his approval. These lists contained non-Federal public works projects which we believe can meet the President's tests calling for the expenditure of over 450 million dollars of which 200 millions will be advanced by the Federal government as outright grants. The President has already allocated approximately 130 million dollars to PWA for the new program which, together with the funds furnished by the applicants will provide for the construction of projects costing approximately 300 million dollars. The President has also allocated 100 million dollars of the new funds to PWA for carrying on its slum clearance and low cost housing program. In addition there is still available the remainder of previous Public Works appropriations. These sums, supplemented by moneys realized from the sale of securities, will enable the new PWA program to embrace the construction of projects costing approximately one billion dollars.

This picture shows men working in an elliptic section of the St. Paul-Minneapolis sewer which is being constructed with an allotment of $16,095,000 of PWA money.

Thousands of meritorious projects are still left in our hands for which funds are not now available. This vast reservoir of public works projects which cannot be undertaken under the present program must not be considered as abandoned. These projects represent the result of local and regional planning of coordinated public works projects, stimulated to a large extent by such agencies as the National Planning Board and the National Resources Board. These are not hastily conceived projects for which plans have been haphazardly drawn. They represent a clear cut attempt to cooperate with the Federal Government in adapting local needs for additional public works to a national program of re-employment.

The Federal Government will not have completed its job when it has spent the last dollar which Congress has so far appropriated for public works. There will still remain the fundamental task of preparing and administering a long range program of Federal public works.

The experience of PWA during the last two years has shown that Federal aid to state and local governments by way of outright grants and loans at low interest rates to finance the construction of local public works projects is an effective weapon against unemployment.

A balanced long range program of Federal public works coordinated with a flexible system of Federal aid to state and local governments must inevitably be recognized by Congress as a necessary function of our national government. A permanent agency in one of the established departments of our Government, or a permanent independent agency charged with the duties of planning and administering public works on a nation wide scale and of coordinating Federal with non-Federal programs is, I am confident, a development in the structure of our Federal Government which must be brought about eventually. Bills have already been introduced into Congress for accomplishing such a result. The Wagner-Ellenbogen Bill, for instance, introduced during the last session of Congress had for its purpose the establishment of a United States Housing Authority to provide adequate large scale housing for families of low income under a long range program. The concept underlying this bill might very well be adapted to all types of public works projects. Federal legislation of a permanent character is the next order of business.

Our immediate job, however, is to carry to completion the President's emergency re-employment program. The foundation for a vigorous and fast moving program of public works has been laid and laid solidly. When PWA was established two years ago we had no tradition of honesty and efficiency in administering a program of economically justifiable public works. We had only the tradition of the pork barrel with all the sense of distrust it aroused in most people and all the sense of greed it aroused in those accustomed to take advantage of the inefficiency and laxity of Government officials. It has been a hard task to make the shift from the port tradition to the intelligent public works tradition, and at times it has been necessary to be slow and to be suspicious to convince those who came to prey upon the program that for the first time the public meant business in its building and meant to get value for its money.

▲ ▲ ▲ ITEMS OF INTEREST ▲ ▲ ▲

The General Offices of Republic Steel Corporation will be consolidated in Cleveland about January 1, it was announced by T. M. Girdler, Chairman of Republic.

This will bring approximately 300 Republic employees to Cleveland. It will unite here the company's executives offices now located in the Union Trust Building, the general offices of the former Corrigan, McKinney Steel Co., the general offices now located in Youngstown, and the advertising department now located in Massillon.

Republic's move will add to Cleveland's extensive steel manufacturing facilities the headquarters of the third largest steel corporation in the United States.

Among the Republic executives who will move to Cleveland from Youngstown are: R. J. Wysor, Executive Vice President and General Manager; N. J. Clarke, Vice President in Charge of Sales; C. M. White, Vice President in Charge of Operations; W. W. Hancock, Secretary and Treasurer, and P. F. Boyer, Comptroller.

With the above named officials the departments now housed in the general office building at Youngstown will be moved.

Already in Cleveland are: T. M. Girdler, Chairman; Myron A. Wick, Vice President, and Donald B. Gillies, former President of Corrigan, McKinney, who is now a Vice President of Republic.

H. B. Carpenter, manager of the Youngstown district of Republic Steel Corp., has been appointed manager of the Corrigan, McKinney properties.

Mr. Carpenter's appointment follows the ratification of the Republic Steel Corp.—Corrigan, McKinney merger.

Mr. Carpenter will have charge of the operations of Corrigan, McKinney properties which include Newton Steel with properties at Monroe, Mich. and Newton Falls, Ohio, and the N. & G. Taylor plant at Cumberland, Md.

Facilities at these plants are: 204 by-product coke ovens, 4 blast furnaces, 14 open hearth furnaces, 2 blooming mills, 2 billet and bar mills, 2 merchant mills, 40 sheet mills, 7 tin mills, and 12 black plate mills.

Mr. Carpenter was born in Pittsburgh, Pa. where he attended high school, and was graduated from the University of Michigan as a chemical engineer. He started working in the steel mills in Pittsburgh during the summer when he was 16, and after leaving college worked as a laborer in both blast furnaces and open hearths.

After several years in the open hearth department he was made first helper in the chemical laboratories of the Cambria Steel Co., later becoming superintendent of the coke plant. He next became assistant to the vice president in charge of operations of the Colorado Steel and Iron Co. and then manager of the steel plant of the same company at Pueblo, Col.

When Republic Steel and Trumbull Steel merged in 1928 he joined Republic Steel as manager of the Youngstown district. He is also president of the Lake Erie Limestone Co.

Many important promotions in the operating organization of Republic Steel Corp. have been announced by Republic officials.

Charles H. Elliott, at present manager of the Warren district, has been named manager of the combined Younstown and Warren district.

Mr. Elliott was born in Wilmington, Ohio, and graduated as a chemical engineer from Purdue University. His first job was as a chemist in the laboratories of the Otis Steel Co. He was open hearth superintendent at the Colorado Fuel and Iron Co. From 1911 to 1919 he was assistant superintendent of blast furnaces and steel plant with the Youngstown Sheet & Tube Co. From there he went to Weirton Steel Co. for five years as manager of the blast furnace and steel plant department.

During 1924 and 1925 he was general superintendent

J. H. VAN CAMPEN

F. E. FLYNN

CHARLES H. ELLIOTT

H. B. CARPENTER

of the South Side works of Jones and Laughlin. In 1926 he came to Warren to the Trumbull Steel Co. as manager of operations. He has been manager of the Warren district for Republic Steel Corp. since the merger.

F. E. Flynn, Assistant Manager of the Warren District, Republic Steel Corporation, has been appointed General Superintendent to succeed Charles H. Elliott.

Mr. Flynn before becoming associated with the Republic organization, had worked at the Superior Steel Company, Carnegie, and the Weirton Steel Company, Weirton.

J. H. Van Campen, special engineer for Republic Steel Corpn., has been appointed chief engineer of the Corrigan, McKinney division, with headquarters in Cleveland. A graduate of Pratt Institute with the degree of mechanical engineer, Mr. Van Campen was employed for a time as a structural iron worker and in 1911 joined the Bethlehem Steel Co. as engineer of its Saucon plant, where he remained for six years. From there he went to the Weirton Steel Co., Weirton, W. Va., as chief draftsman. He became assistant chief engineer of the Midvale Steel Co., Coatesville, Pa., in 1920, and after remaining there for five years became special development engineer for the Timken Roller Bearing Co., working particularly on large bearings for mills. Subsequently he became chief engineer of the E. W. Bliss Co. at Salem, Ohio, where he remained two years. This was followed by four years as chief engineer for the Youngstown and Warren districts of the Republic Steel Corpn., which he left to spend a year in Japan doing special work for the United Engineering & Foundry Co., and on his return became special engineer for Republic.

C. A. Ilgenfritz has been appointed manager of purchases and raw materials for the Republic Steel Corp.

Mr Ilgenfritz will also look after leases, sale and purchase of properties, scheduling and all other matters pertaining to raw materials.

Mr. Ilgenfritz was formerly director of purchases.

Walther Mathesius was appointed, effective Oct. 1, manager of operations in the Chicago district for the Carnegie-Illinois Steel Corpn. Mr. Mathesius was born in Berlin, Germany, and was graduated in 1911 from the Institute of Technology of that city. His first work in this country was at the Worcester plant of the American Steel & Wire Co. In 1912 he entered the blast furnace department of South works, Illinois Steel Co. In 1917 he was made superintendent of that department and in 1925 he was promoted to assistant general superintendent. He was made general superintendent of South works in the early part of 1935, this being the position he held at the time of his promotion to manager of operations for the Chicago district.

▲

E. E. Moore has been named general superintendent of South works, succeeding Mr. Mathesius. Mr. Moore made his start at the Gary tin mills in 1919 and in 1925 he was appointed assistant manager of the Shenango works, American Sheet & Tin Plate Co. He returned to the Gary tin mills in 1927 as assistant manager and in 1932 he was made assistant to the vice-president, Illinois Steel Co.

The following additional appointments in the Carnegie-Illinois Steel Corpn. were made effective on Oct. 1: William C. Oberg, manager of operations Pittsburgh district; Sydney Dillon, chief engineer; C. F. W. Rys, chief metallurgical engineer; John A. Hagen, chief industrial engineer; R. B. Porter, manager of operations Lorain division; Charles B. Getsinger, director of fuel and power; Fred E. Kling, chief engineer Pittsburgh district; Edward T. Barron, manager metallurgical department Pittsburgh district, and John Brunner, manager metallurgical department Chicago district.

▲

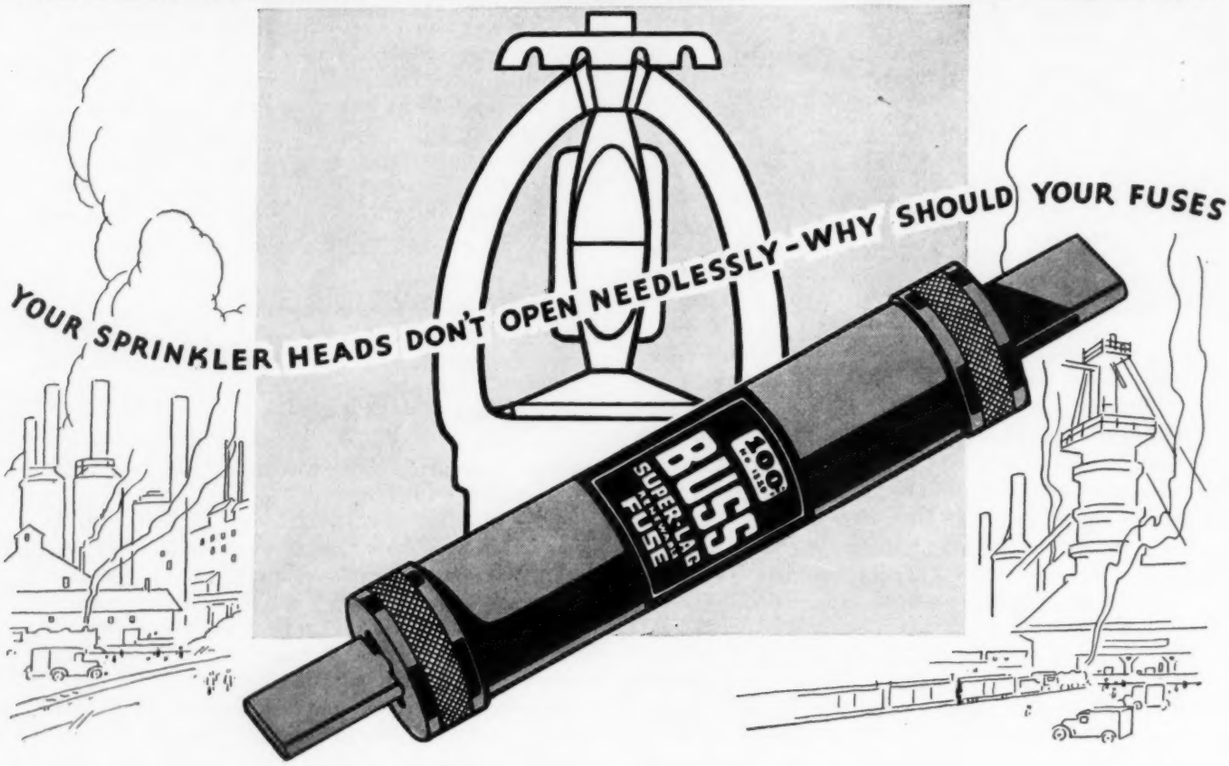
David E. Jenkins has been appointed assistant to Benjamin F. Fairless, president Carnegie-Illinois Steel Corpn., Pittsburgh. Mr. Jenkins has been identified with the steel industry for about 27 years. He went with the American Sheet & Tin Plate Co. in 1908, and in 1917 he became associated with Timken Roller Bearing Co., Canton, Ohio. In 1924 he joined United Alloy Steel Corpn., remaining with that organization until it merged with Central Steel Co. at Massillon to form Central Alloy Steel Corpn. He stayed at Massillon until the formation of the Republic Steel Corpn. in 1930, when he went to Youngstown as assistant to Mr. Fairless, who then was first vice-president of the Republic organization.

▲

The Carnegie-Illinois Steel Company, Tennessee Coal, Iron and Railroad Company, American Steel and Wire Company and the American Sheet and Tin Plate Company, subsidiaries of the United States Steel Corporation, will consolidate their sales offices in Detroit. Mr. Phillip M. Guba has been appointed Manager of Sales for each company and Mr. Howard B. MacGuire and Mr. Howard V. Clark, Assistant Managers of Sales. Mr. James A. Smith, Jr. has been appointed Office Manager. All of these

(Continued on page 40)

FUSES MADE TO PROTECT · NOT TO BLOW



GET THE FACTS — "*We have been having considerable expense blowing an average of one to two 500 ampere fuses per day on the compressor pumps. On Oct. 28th installed BUSS Super-Lag Fuses and have not had a blow to date (Dec. 16th)...We are BUSS boosters from now on.*"

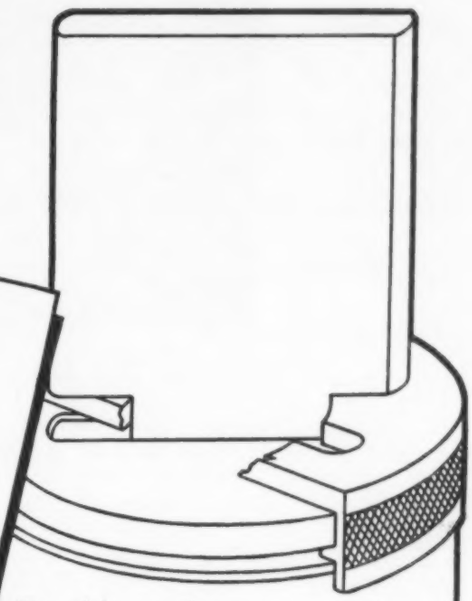
Mr. B. Pomeroy speaking, *Master Mechanic* of the VIERLING STEEL WORKS, Chicago. His present fuses are *Made to Protect* . . . NOT TO BLOW.

The "considerable expense" referred to was not the comparatively small fuse expense...but that real, considerable and riotously wasteful expense in any factory...which is

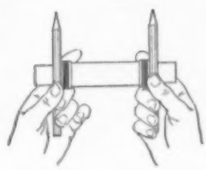
. . . the RECURRING SHUTDOWNS *caused by* NEEDLESS BLOWS

"Inadequate" is a polite word for a fuse-case that creates self-built hazards and that forces the terminals to heat up sufficiently to blow ANY link. And that is but one of MANY causes of the recurring, needless shutdowns that repeatedly raid your earnings. Investigate . . . . . .

WHY BUSS FUSES DON'T BLOW NEEDLESSLY
10 Features
in the design of the FUSE-CASE help make it possible and . . . .
The Super-Lag
development in the FUSE LINK completes the job.



Try this on the terminals of a BUSS fuse.



NOTE HOW THEY LINE UP

ALWAYS LIKE THIS

NEVER LIKE THIS

They are locked — you can't twist them out of line.

Now try this test on other fuses.

* * *

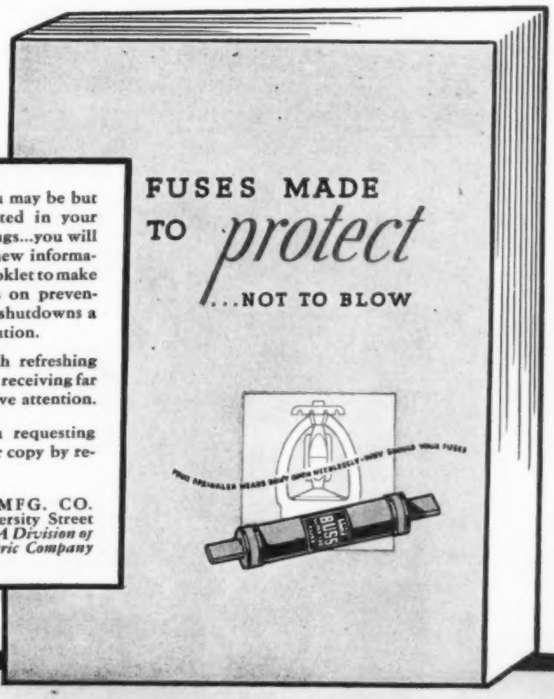
Comparisons may be odious — but this one is OBVIOUS.

Isn't it obvious that unless the terminals of your fuse are in perfect alignment you will not get good contact?

Isn't it obvious that where contact is bad heating must occur — and the poor *self-heated* fuse soon thinks it is handling a dangerous overload—and BLOWS — NEEDLESSLY — exacting from you the *surtax* of a shutdown?

And isn't it obvious that the troubles that blow fuses should originate in circuits, not in fuses?

GET THE FACTS



Even though you may be but remotely interested in your company's earnings...you will obtain enough new information from this booklet to make your suggestions on prevention of needless shutdowns a valuable contribution.

It is replete with refreshing facts on a subject receiving far too little executive attention.

A line from you requesting it, will bring your copy by return mail.

BUSSMANN MFG. CO.
2536 West University Street
St. Louis, Mo.... *A Division of the McGraw Electric Company*

BUSS super-lag FUSES

ADVERTISING PAGES REMOVED

J. D. JONES

F. A. BEATTY

J. D. Jones, who has recently been appointed chief engineer of The Youngstown Sheet & Tube Co., was born and raised in Pittsburgh and went to school at Pittsburgh Academy. From the outset he was interested in the steel business. He set out at once to obtain a wide range of experience in the production of steel. He worked in steel plants in Wheeling, Chicago, Buffalo, Pittsburgh and other cities.

In 1912 Mr. Jones went to Sault. Ste. Marie as chief engineer of the Algoma Steel Co. In 1916 he went to the Gary works of the Illinois Steel Co. as chief engineer, and left there in the latter part of 1919 to return to the Algoma Steel Co. at the Soo as general superintendent, later becoming general manager and vice president. He came to The Youngstown Sheet & Tube Co. early in August.

▲

ITEMS OF INTEREST

(Continued from page 37)

men are well known in the Detroit area, having represented their respective companies for some time. This was effective Sept. 20, 1935.

▲

The Clark Controller Company of Cleveland has appointed the Harris-Green Company of the Farmers Bank Building, Pittsburgh, Pa. as Sales-Engineering Representatives. The Pittsburgh Branch Offices of Clark will be maintained as at present.

▲

OBITUARY

It is with deep regret that the Association announces the death on September 9 of Mr. M. E. McGrail, Assistant General Superintendent, Great Lakes Steel Corporation, and an active member of the society for the past 21 years.

Before becoming associated with the Great Lakes Company, Mr. McGrail had been identified with the Westinghouse Electric & Manufacturing Company, United Alloy Steel Company, and the American Rolling Mill Company.

Mr. Frank Cordes, President of Lewis Foundry and Machine Company, a subsidiary of Blaw-Knox Company, announces the appointment, effective October 1st, 1935, of Mr F. A. Beatty, chief engineer of the company as a vice president of Lewis Foundry and Machine Company, Pittsburgh, Pa. Mr. Beatty's experience has been along extremely broad lines. As a mechanical and structural engineer he was connected successively with Standard Plate Glass Company, American Rolling Mill Company, Spang & Company, Jones & Laughlin and in 1923 became assistant to the chief engineer of Lewis Foundry & Machine Company. In 1927 he assumed the duties of Chief Engineer of this company a capacity in which he continues at the present time.

▲

STATEMENT OF OWNERSHIP, MANAGEMENT, ETC., OF

IRON AND STEEL ENGINEER

(Required by Act of Congress of August 24, 1912)

Name of Publication: Iron and Steel Engineer, published monthly at Pittsburgh, Pa. (Report of October 1, 1935).

Editor—T. B. Little, Empire Bldg., Pittsburgh, Pa.

Acting Business Manager—T. B. Little, Empire Bldg., Pittsburgh, Pa.

Names and addresses of stockholders holding 1 per cent or more of total amount of stock: None.

BOARD OF DIRECTORS
1935-1936

PRESIDENT, G. R. CARROLL, Electrical Superintendent, Jones & Laughlin Steel Corporation, Aliquippa, Pa.

FIRST VICE PRESIDENT, F. W. CRAMER, Supt. Elect. Const., Republic Steel Corp., Youngstown, Ohio.

SECOND VICE PRESIDENT, J. A. CLAUSS, Chief Engineer, Great Lakes Steel Corp., Ecorse, Mich.

DIRECTOR AT LARGE, C. A. KRAL, Asst. General Manager, Wheeling Steel Corp., Steubenville, Ohio.

HONORARY DIRECTOR, J. FARRINGTON, Elect. Supt., Wheeling Steel Corp., Steubenville, Ohio.

HONORARY DIRECTOR, E. FRIEDLANDER, Pittsburgh, Pa.

PAST PRESIDENT, W. H. BURR, Elect. and Mech. Supt., Lukens Steel Co., Coatesville, Pa.

PAST PRESIDENT, W. E. MILLER, Elect. and Mech. Supt., Bethlehem Steel Co., Johnstown, Pa.

TREASURER, C. H. HUNT, Asst. to Pres., Weirton Steel Co., Weirton, W. Va.

SECRETARY, J. L. MILLER, Asst. Chief Engr., Carnegie Steel Co., Youngstown, Ohio.

DIRECTOR, C. J. SMITH, Supt. of Auxiliary Depts., Illinois Steel Co., S. Chicago, Ill.

DIRECTOR, H. G. R. BENNETT, Asst. General Supt., Carnegie Steel Co., Duquesne, Pa.

DIRECTOR, STANLEY GRAND-GIRARD, Mech. and Elect. Supt., Sharon Steel Hoop Co., Sharon, Pa.

DIRECTOR, C. R. TINSLEY, Elect. and Mech. Supt., United States Pipe & Foundry Co., Bessemer, Ala.

DIRECTOR, M. J. CONWAY, Fuel Engr., Lukens Steel Co., Coatesville, Pa.

DIRECTOR, C. C. PECU, Lubrication Engr., Bethlehem Steel Co., Lackawanna, N. Y.

DIRECTOR, C. C. WALES, Chief Engr., Otis Steel Co., Cleveland, Ohio.

DIRECTOR, L. F. COFFIN, Supt., Mechanical Department, Bethlehem Steel Co., Sparrows Point, Md.

DIRECTOR, J. A. VOSS, Manager Industrial Relations, Republic Steel Corp., Youngstown, Ohio.

Known bondholders, mortgagees and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities: None.

T. B. LITTLE, Editor.

Sworn to and subscribed before me this 30th day of September, 1935.

HENRY W. BALDWIN, Notary Public.

(My commission expires April 16, 1937)